BULLETIN

OF THE

MADRAS GOVERNMENT MUSEUM

EDITED BY THE SUPERINTENDENT

DECAPOD LARVAE FROM THE MADRAS PLANKTON

BY

M. KRISHNA MENON, M.A., M.Sc.

New Series—Natural History Section Volume III, No. 5

MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1931

PRICE LIST OF
MADRAS GOVERNMENT MUSEUM BULLETINS (NEW SERIES).

Reference.	Title.	Pages.	Plates.	Price.
Natural History Section (with separate volumes for Zoology and Botany respectively).				Rs. A. P.
* Vol. I, No. 1, 1927 ...	The Littoral Fauna of Krusadai Island in the Gulf of Manaar. (In various authors.	198	26	8 0 0
† Vol. I, No. 2, part 1, 1936.	Supplement to the Littoral Fauna of Krusadai Island in the Gulf of Manaar. (In various authors.	72	1	2 0 0
„ Part 2, 1931.	Supplement to the Littoral Fauna of Krusadai Island in the Gulf of Manaar. By Sydney J. Hickson, D.Sc. (with three text figures).	8	Nil.	0 4 0
„ Part 3, 1936.	Supplement of Krusadai Island. By M. O. P. Iyengar, D.Sc.	9	1	0 8 0
* Vol. II, 1927	The flowering plants of Madras City and its immediate neighbourhood. By P. V. Mayuranathan, B.A.	210	38	8 0 0
Vol. III, No. 1, 1930.	The Scyphomedusae of Madras and the neighbouring coast. By M. O. P. Iyengar, M.A.	28	3	1 8 0
„ No. 2, 1932.	The Hydromedusae of Madras. (In two parts.)	32	3	1 4 0
„ No. 3, 1935.	The Lucifer-Penaeus of Decapod Crustacea from Madras. By M. Krishna Menon, M.A.	42	10	Bound together. 2 8 0
„ No. 4, 1935.	Reptiles of the Madras Coast. By C. C. John, M.A., B.Sc.	30	1	
Vol. IV, No. 1, 1937.	The Indian Species of Genus Candidate (Fam. Ascidiidae). By F. H. Gravely, D.Sc., and P. V. Mayuranathan, B.A.	88	4	1 8 0
General Section (with separate volumes for Anthropology and Archaeology respectively).				
* Vol. I, No. 1, 1929 ...	Buddhist Sculptures from a stupa near Goli village, Guntur district. By T. N. Ramachandran, M.A.	44	5	2 12 0
„ No. 2, 1932 ...	Catalogue of the South Indian Hindu Metal Images in the Madras Government Museum. By F. H. Gravely, D.Sc., and T. N. Ramachandran, M.A.	144	63	7 8 0
„ No. 3, 1934 ...	Tirupparuttikunram and its temples, with appendices on Jaina antiquities, numismatics and coins, chronology and classification of works. By T. N. Ramachandran, M.A.	260	37	11 4 0
Vol. II, No. 1, 1930.	The Amblambulae shells by S. Kesteven, M.A., M.R.C.S., L.R.C.P., with Notes By Prof. G. Elliot Smith, M.A.	44	1	1 8 0
„ No. 2, 1931.	The Sri Vaishnava Brahmans. By Diwan Bahadur R. Sangacharl, M.A., L.T.	158	11	1 12 0
„ No. 3, 1932.	Catalogue of the Musical Instruments exhibited in the Government Museum, Madras. By P. Sambamoorthi, B.A., B.L.	83	9	1 8 0
Vol. III, No. 1, 1936.	The Three main Styles of Temple Architecture recognized in the Silpasastras. By F. H. Gravely, D.Sc., and T. N. Ramachandran, M.A.	46	8	1 0 0
„ No. 2, 1936.	An Outline of Indian Temple Architecture. By F. H. Gravely, D.Sc.	42	7	0 12 0

* Volumes ready for binding. Title page and list of contents separately issued in case of volumes issued in several parts.

† This number is being reserved for supplement to the Krusadai Island (1936).

CONTENTS

DECAPOD LARVAE FROM THE MADRAS PLANKTON

By M. Krishna Menon, M.A., M.Sc.

From University Zoological Research Laboratory, Madras, and Department of Zoology, Maharaja's College, Ernakulam.

In a previous paper the author has described the larvae of four species of Decapods of the Madras Coast. They were obtained from the plankton, and the regular collection and examination of the latter necessitated by that work revealed the presence in it of large numbers of larvae belonging to numerous other species. These were preserved separately. No attempt was made then for want of time to identify or otherwise deal with them; but in a number of cases the first, and in a few some of the later, post-larval stages also were obtained in the laboratory by keeping specimens of the previous stages in sea water, till they moulted. In this way a fairly large amount of material accumulated in the course of an year.

Early last year a preliminary examination of the collection was made and then it was found that fairly complete series of larvae of a number of forms were present. This encouraged me to undertake a systematic study of the whole collection. The work could not be finished in the University Zoological Laboratory as I had to leave Madras, and the material was sent to me by the Director for further study at the Maharaja's College, Ernakulam. The scope of the paper had to be narrowed down as the works of Claus, Cano and Sars were not available and thus only 16 forms are dealt with in this paper, representing barely half of the collection. Fortunately, however, they include almost all the forms of which the collection contained complete series of larvae.

Identifications of the species, wherever they are given, have been based on the study of fairly advanced post-larval stages, except in the case of *Spiropagurus spiriger* and *Diogenes pugilator*. In the other cases I have ventured to indicate only the genera, clues to the identity of which were obtained either by comparison of the larvae with similar ones described by others or by studying the first post-larval stages or megalopae. The treatment of the various forms cannot in the circumstances be uniform, since in some the series were not complete and in others notes on colouration, size and habits had not been taken down at the time of collection.

I am grateful to Professor R. Gopala Ayyar, Director of the former institution not only for his invaluable help while working under him, but also for permitting me to take away the material on loan. I am also indebted to Professor K. Karunakaran Nair of the Maharaja's College, for providing me with all facilities for completing the work in his Laboratory, permission for which was kindly granted by the Cochin Government.

Suborder NATANTIA.

Tribe PENAEIDEA.

Family PENAEIDAE.

Penaeus indicus, Milne Edwards.

Only four stages of this species were present in the collection, three protozoeal stages and the first mysis stage.

First Protozoea Stage—Fig. 1—Length about 1 mm.—There is a broad oval carapace covering up to the second segment of the thorax. The stalked eyes occur as thickenings of the anterolateral portions of the carapace, between which there is a small nauplius eye. A minute papilla, the frontal organ, projects from the anterior margin of the carapace on each side. The labrum has a conspicuous spine.

Antennule.—This is a uniramous rod which has got 5 narrow joints at its base, beyond which there are 2 more that are longer The sixth segment has a long seta distally and the last is tipped with 6 setae, one of which is very long.

Antenna.—The protopodite is two jointed. The exopodite has 9 segments. Of these 4 to 8 have each a long seta on its inner border. The last has 5 long setae at its tip. Segments 4 and 6 have each a seta on the external border also.

Mandible.—The cutting edge bears a number of teeth, the two most ventral of which are the largest.

First Maxilla—Fig. 2.—The two protopodite segments are drawn out inwards into 2 endites, the proximal of which is armed with several short setae. The distal endite has only 3, of which 2 are not jointed off from it. Endopodite is three jointed of which the first joint has 3, the second 2 and the last 5 setae. Exopodite is knoblike and bears 4 plumose setae, the hindermost of which is much larger than the others.

Second Maxilla—Fig. 3.—The usual 4 endites are present. The most proximal of them is the largest and is armed with several setae. The others have only 3 or 4 each. Endopodite has 5 segments, each of the first 4 of which is armed with a couple of setae. The last joint has 3 setae terminally. Exopodite has 4 plumose setae of which the one springing from the hinder end is the largest.

First Maxilliped—Fig. 4.—Coxopodite is produced inwards into 3 imperfectly developed masticatory prominences armed with a few setae. Basipodite also has the same number ; but they are better developed. Endopodite is four jointed. The first joint has 3 setae, the second and third have 2 each and the last has 5 large ones. Exopodite is shorter and unjointed and has 7 plumose setae, 2 of which are terminal, one on the inner margin and the remaining 4 on the outer margin.

Second Maxilliped.—The masticatory processes on the inner margin of the protopodite segments are imperfectly developed and bear fewer setae. Endopodite has the same number of segments as that of the first maxilliped ; the first 3 segments have 2 setae each and the last 5. Exopodite is similar to that of the first except for the presence of only 3 setae on its outer margin.

Posteriorly the remaining 6 segments of the thorax and the first somite of the abdomen are clearly differentiated. But they bear no appendages. The rest of the abdomen is unsegmented.

Telson.—The telson is forked. Each fork is short and rounded posteriorly and is armed with 7 ciliated setae of which the fourth from the outside is the largest.

Stage II—Fig. 5.—Length 1.75—2 mm.—The stalked eyes are now completely free from the carapace. At its anterior end there is a long pointed rostrum which takes its origin rather abruptly and on either side of it and projecting over each eye there is a supra-orbital spine with a small spinule on its outer margin. The labral spine has shrunk considerably.

Antennule and Antenna.—They remain in much the same condition.

First Maxilla.—The distal endite is now armed with several setae.

Second Maxilla.—There are 5 plumose setae on the exopodite.

Maxillipeds.—The first and second maxillipeds are practically unaltered.

Other Thoracic Appendages.—Very small knoblike rudiments of all the posterior thoracic appendages are present.

Abdomen.—The first 5 somites are clearly differentiated but are without pleopods. The telson is unchanged.

Stage III—Fig. 6.—The general appearance of the larva is the same as that of the previous stage. At the base of the rostum there is a small tooth on each side. The supra-orbital spine persists ; but the small spinule on its outer margin has disappeared.

Antennule.—This is now composed of only 4 segments owing to the fusion of the five basal joints of the previous stages into one and the division of the next into two. The terminal segment has all the setae of the preceding stages while each of the others has 2 or 3 small ones.

Antenna.—Exopodite has now 11 segments, the last having only 3 setae.

Mandible.—The mandible is still palpless.

Maxillae.—The first and second maxillae are practically unaltered except for the increase in the number of setae on the endites.

First and Second Maxillipeds.—Protopodites and endopodites show no change. Exopodites have 2 more plumose setae, one on the outer and the other on the inner margin so that in the first it has 9 and in the second 8 plumose setae respectively.

Third Maxilliped.—This is now a biramous appendage, but the rami are unjointed and tipped with 4 setae.

Other Thoracic Appendages.—The rudiments of the remaining thoracic appendages are much larger than they were in the previous stage and are biramous (Fig. 6).

Abdomen.—All the 6 segments are now well differentiated. The first 5 segments have each a dorso-median spine at the posterior edge. Segments 5 and 6 have each a pair of postero-lateral spines also. Pleopods are absent; but the uropods have appeared. Each is biramous (fig. 7), the endopodite which is slightly the shorter branch being tipped with 2 setae and the exopodite with 6. The telson shows no change.

This stage is the last protozoea stage since specimens belonging to it kept in the laboratory metamorphosed into the first mysis stage directly in a couple of days. Since the first 2 stages described above correspond in all essentials to the first 2 protozoea stages of allied species studied by other authors there seem to be only three protozoeal stages in the development of the present species, a fact which is in agreement with Gurney's conclusion regarding the number of protozoeal stages in the Penaidea.

First Mysis stage—Length 3 *mm.*—The long pointed rostrum of the preceding stage is still present; but the small teeth at its base have disappeared. The supra-orbital spines persist practically unaltered. Besides these a small hepatic spine has appeared laterally some distance behind the base of the antenna. The nauplius eye still persists.

Antennule—Fig. 8.—A three jointed peduncle and 2 flagella are now present. The basal joint of the former is slightly swollen and the rudiment of the stylocerite is present on its outer side. At about the middle of its inner side there is a conspicuous sharp spine and beyond it a plumose seta. The second segment has 3 such setae on the same side and the third 2. The last has 3 more at its distal end. A few small setae are present at the junctions of the segments. The outer flagellum is larger; it is unjointed and carries 5 aesthetes and a few setae at its tip. The inner has two setae of unequal length terminally.

Antenna—Fig. 9.—A peduncle of 2 short joints is present. The flagellum is shorter than the scale, is unjointed and is tipped with setae. The scale has 10 plumose setae arranged along its inner margin and tip and 2 more on the outer margin close to the tip.

Mandible.—The palp is still absent.

First Maxilla.—The distal endite is now much bigger than the proximal.

Second Maxilla—Fig. 10.—The proximal endite is larger than the others and is armed with several setae. The palp is similar to that of the preceding stages. The scale is bordered with 10 plumose setae.

First Maxilliped—Fig. 11.—The coxopodites and basipodites are much as they were in the previous stages. Segments 1, 2 and 4 of the endopodite have each a single seta on its outer margin. The exopodite has 11 plumose setae, 6 on the outer margin, 2 terminally and 3 on the inner margin.

Second Maxilliped.—The protopodite has fewer masticatory lobes. The endopodite is similar to that of the first. The exopodite unlike that of the first, is long and slender and tipped with 6 setae.

Third Maxilliped—Fig. 12.—Coxopodite has no masticatory lobe. Basipodite has but 3 setae on its inner margin. Endopodite is five-jointed. Segments 1 and 2 have each one seta on the inner margin; segment 3 has none and segment 4 has 2. The last has 4 setae terminally and one on the outer margin. Segments 3 and 4 also have each an outer seta. Exopodite is similar to that of the second maxilliped.

Peraeopods.—All the peracopods are well developed and biramous with functional exopodites. The latter are long and slender and armed with 8 plumose setae (Fig. 13). Endopodites are much shorter and very imperfectly jointed, but show rudimentary chelae in the first 3 pairs.

Gills.—Gills are not yet developed.

Abdomen.—The first 5 segments have lost their dorso-median spines; but the sixth has developed one. The lateral spines of the fifth and sixth are still retained. The last segment is comparatively very long, being about equal in length to the preceding 3 somites and has a median ventral spine at its posterior end. Pleopods are not yet developed.

The uropods (Fig. 14) are better developed than they were in the previous stage. The protopodite has a spine on its ventral side. Exopodites and endopodites are elongated lamellae. The former have each a spine on their outer margin and 16 plumose setae arranged on the inner margin, tip and distal end of outer margin. The latter each have about 13 similar setae, the outer border, except at the extreme tip, being devoid of them.

Telson.—The telson is elongated and roughly oblong, with a deep median incision in its posterior border. On each side of this there are 7 setae, the third of which from the outer side is the largest. Each lateral margin has a spine, some way behind the middle.

As this is the only mysis stage present in the collection nothing is known about the number of later stages.

Tribe CARIDEA.

Family PASIPHAEIDAE.

Leptochela ? aculeocaudata, Paulson.*

Stage I—Fig. 15.—The carapace is broadly oval and is produced in front into a short pointed rostrum. Posteriorly it is slightly concave in the middle and the angles are rounded. The body is transparent with red chromatophores close to the mouth, at the hind end of the cephalothorax and at the base of the antennae.

The eyes are well developed, but not free, being fused with the anterior margin of the carapace.

Antennule—Fig. 16.—This consists of a short unjointed peduncle and 2 rudimentary flagella. The inner flagellum is very small and is tipped with a stout plumose seta. The outer has 3 aesthetes and a seta terminally.

Antenna—Fig. 17.—A short peduncle, a scale and a rudimentary flagellum are present. The last-mentioned part is less than half the scale in length and carries a single plumose seta at its tip. The scale has a straight outer margin produced distally into a sharp spine. Along the inner margin and tip are arranged 9 plumose setae and an additional reduced one is present just internal to the spine.

Mandible—Fig. 18.—As shown in the figure.

First Maxilla—Fig. 19.—There are two endites and a palp. The latter is two jointed, each joint carrying a seta at its distal end.

Second Maxilla—Fig. 20.—Four endites are present, the most proximal of which is the largest. The palp is unjointed and has 3 setae on its inner margin and two at the tip. The scaphognathite is small with 3 plumose setae anteriorly and 2 at the posterior end.

First Maxilliped—Fig. 21.—The basipodite alone has a well-developed masticatory lobe bearing setae. Endopodite has 4 segments the third of which is considerably longer than the others. Each of the first three has a single seta on the inner margin and the last has 3 at the tip and a small one on the outer border. Exopodite has 2 joints the distal of which is tipped with 4 plumose setae.

Second Maxilliped.—The masticatory lobe of the basipodite is poorly developed. Endopodite is similar to that of the first except for the presence of a fifth short seta at the tip of the last joint. Exopodite resembles that of the first.

* I am indebted to Dr. R. Gurney for suggesting the genus of this form.

Third Maxilliped.—The basipodite has no masticatory lobe. Endopodite has the same number of segments, of which the first and the third have each 2 setae on the inner border. The last segment is exactly similar to that of the preceding appendage. Exopodite has 5 plumose setae.

Other Thoracic Appendages.—Only the first peraeopod is present in the form of a small rudiment.

Abdomen.—This consists of 5 segments and the telson. The last segment is thinner but longer than the others and has a pair of small posterolateral spines. The telson has a convex posterior border containing a small median notch. On either side of this there are 7 spines of which the third and fifth are larger than the others.

Stage II—Length 2 mm.—The eyes are now completely free. The anterolateral corner of the carapace is produced into a sharp spine. A similar but smaller spine is present above the ocular peduncle. Between them there are 9–10 minute teeth. Behind the suborbital spine the edge of the carapace has 3 large teeth.

Antennule—Fig. 22.—The distal segment of the peduncle is now cut off. The flagella have not grown much ; the outer one has one more seta at its tip.

Antenna.—The flagellum has lost its seta The scale remains unaltered. The peduncle bears a long slender spine opposite to the base of the flagellum.

Mandible.—The mandible shows no change.

First Maxilla.—Each joint of the palp has 2 setae in this stage.

Second Maxilla.—The palp has one more seta on its inner margin.

First Maxilliped —This appendage shows no change.

Second Maxilliped.—Endopodite has 5 segments now, the last segment having all the setae of the previous stage and in addition to them one on the outer margin. Exopodite has 5 plumose setae terminally.

Third Maxilliped.—Endopodite is five jointed and its first segment has a seta on the outer margin. Exopodite has 6 plumose setae.

Peraeopods.—Only the first peraeopod rudiments are present in this stage also.

Abdomen.—The number of segments remains the same. The telson (Fig. 23) has now 8 spines on each side, a small additional spine having made its appearance on either side of the notch.

Stage III—Length 2·75 mm. The appearance of the first pair of peraeopods with functional exopodites, and of the sixth abdominal segment with uropods, constitute the distinguishing characteristics of this stage. The rostrum has diminished in size being little more than a triangular process. The supraorbital spine has practically disappeared ; the suborbitals and the lateral teeth persist. Four or five similar teeth have appeared at the hinder part also of the lateral margin.

Antennule—Fig. 24.—The peduncle has undergone little change. The inner flagellum has now elongated considerably, so that it is much longer than the outer. It has an acute extremity but bears no setae. Opposite to its base a large plumose seta arises from the peduncle. The outer flagellum is more or less as it was in the previous stage.

Antenna—Fig. 25.—The scale is now bordered with 12 plumose setae including the reduced one adjacent to the spine. The flagellum has grown and is now about 2/3 the scale in length.

Mandibles.—The mandibles of the two sides are not quite similar.

First Maxilla.—There is a small plumose seta near the base of the palp.

Second Maxilla.—The endites and palp do not show much development. The scale has 7 plumose setae.

The *First maxilliped* is hardly changed.

Second Maxilliped.—The first and fourth segments of the endopodite have each a seta on their outer border. The exopodite has 6 plumose setae.

Third Maxilliped.—Remains as it was in the previous stage.

First Peraeopod—Fig. 26.—This is a biramous appendage with an exopodite similar to that of the maxillipeds with 6 swimming setae. Endopodite is unsegmented, about as long as the proximal joint of the exopodite and tipped with 2 setae.

The next two pairs of peraeopods are represented by small rudiments.

Abdomen.—There are 6 segments now besides the telson. The fifth and sixth have each a pair of posterolateral spines. Pleopods are not yet developed, but the uropods are present. The latter are biramous with small endopodites tipped with 2 setae and large exopodites carrying 6 setae along their inner margin and tip.

Telson.—The telson is more or less similar to that of the previous stage.

Stage IV—Fig. 27.—Length 3·5 mm. The animal shows a marked increase in size. The rostrum is in the same condition as it was in the previous stage. All the spines and teeth of the last stage persist in this also.

Antennule—Fig. 28.—The peduncle still shows only 2 segments. The outer flagellum has grown to some extent, but is still shorter than the other and has the same number of aesthetes and setae as in the previous stage. The inner has a couple of small setae towards its extremity. Both are unsegmented.

Antenna—Fig. 29.—The scale has now 14-15 plumose setae. The flagellum is slightly longer than the scale, but is unsegmented.

Mandible—Fig. 30.—Is as shown in the figure.

First Maxilla—Fig. 31.—It is very similar to that of the third stage.

Second Maxilla—Fig. 32.—The scale has 9 plumose setae now.

First Maxilliped.—The coxopodite bears a fingershaped epipodite.

The two remaining pairs of maxillipeds are similar to those of the previous stage.

First Peraeopod—Fig. 33.—The endopodite is now fully developed with all its 5 joints and is chelate terminally. The exopodite has the same 6 setae of the previous stage.

Second Peraeopod—Fig. 34.—This is also biramous. Endopodite is quite similar to that of the first. Exopodite is a small process, as long as first joint of endopodite and is unarmed.

The remaining 3 pairs of peraeopods are still only uniramous unjointed rudiments. Gills are not yet developed.

Abdomen.—The pleura of the abdominal segments are well developed ; those of the second segment already overlap the hinder end of the first and the front end of the third. Those of the third, fourth and fifth somites have a small tooth at their middle. The fifth segment has 2 pairs of spines at its hinder end, a smaller ventral pair and a larger lateral pair. The last somite has a pair of long spines at the posteroventral angles and a pair of slightly smaller ones at the corresponding dorsal angles. All except the first have pleopods.

Each pleopod is biramous, having an unjointed peduncle and two short rami which are neither segmented nor armed with setae.

Uropods—Fig. 35.—The exopodite has now a long spine at the distal end of its outer margin and 10 plumose setae internal to it, the first of which is much smaller than the others. The endopodite is slightly smaller and has 7 plumose setae and two more small ones at the tip of its external margin.

Telson.—This is roughly oblong in shape, the length being about twice the breadth of the hinder end. The posterior edge is remarkably convex and the median notch of the preceding stages has completely disappeared. It bears 12 spines. A small spine is present at about the middle of the lateral margin.

First Post-Larval Stage.—The earliest post-larval stage present in the collection is hardly larger than the last larval stage described above. It seems therefore that there are only 4 larval stages in this species. The appendages (figs. 36 to 45) and telson of the animal at this stage are very similar to those of *Leptochela*. But the presence of only a vestigial exopodite for the third peraeopod and its absence in the last two pairs of legs is a remarkable feature. In a slightly older specimen these appendages are still in the same condition, but whether they remain so in the adult is not known.

The abdominal segments are more or less as they were in the last stage, with all the spines persisting. The first segment is apparently without pleopods ; but rudiments of these in the form of papillae are present. In the other somites they are well developed, with the two rami fringed with swimming setae. The telson is armed with the same number of spines ; but the posterior extremity is much narrower.

In older specimens about 4·5 mm. in length, these rudiments have grown and consist of protopodite, exopodite and a minute endopodite which are only obscurely differentiated. In a still older specimen of about 6 mm. they are fully grown and the exopodites are fringed with setae distally. But the endopodites are still very small and carry 2 or 3 setae at their tips.

The characteristics of the appendages and the presence of only two dorsal spines on the telson indicate that the specimen is probably *Leptochela aculeocaudata*. According to Kemp this is the most common species occurring in British India. The absence of exopodites in the last 2 pairs of legs offers, of course, a serious difficulty in the identification ; but in the absence of information on this point in the adult, the identification seems justified as a tentative hypothesis.

Suborder REPTANTIA.

Section ANOMURA.

Family ALBUNEIDAE.

Albunea symnista, Linnaeus.

Larvae of *Albunea symnista* are not found in such large numbers as those of *Emerita asiatica*. Though there is considerable general resemblance between the two, those of the former can be readily distinguished from those of the latter by the shape of the carapace and telson.

Stage I—Fig. 46.—The carapace is highly arched as that of *Emerita* larvae, but with this difference, that whereas the arching in the latter is perfectly regular it is not so in the former inasmuch as there is a prominent longitudinal ridge running along the middle. In

front it is produced into a long rostrum which projects forwards and downwards. There is a pair of lateral spines also, a feature in which it differs from the first stage of *Emerita*. They are shorter than the rostrum.

The animal is transparent with dark red chromatophores at the base of the eyestalks, the base of the lateral spines and in the telson.

The eyes are free with rather short peduncles.

Antennule—Fig. 47.—This is an unjointed process reaching up to about half the length of the rostrum and is tipped with an aesthetsac and 4–5 setae.

Antenna—Fig. 48.—This consists of an unjointed peduncle and a scale. The former bears at its distal end a very large spine, as long as the scale. The latter carries 10 plumose setae on its inner and distal margins.

Mandible—Fig. 49.—The cutting edge has numerous small teeth as shown in the figure.

First Maxilla—Fig. 50.—The two usual endites are present, the proximal of which bears 3 setae and the distal 2. The latter are much larger than the others and are not sutured off from the endite. The palp is small and bears a single seta.

Second Maxilla—Fig. 51.—There are only three endites as shown in the figure. The palp is unjointed and carries four setae of unequal length. The scaphognathite is devoid of setae at the hinder end as in *Emerita* ; anteriorly there are 9 plumose setae.

First Maxilliped—Fig. 52.—The basipodite is much longer than the coxopodite and is armed along its inner border with 11 setae. Endopodite is five jointed, the first joint has 3 setae the second 2, the third 1, the fourth 2 and the last 4 at the tip and 1 on the outer border. Exopodite is unjointed and tipped with 4 plumose setae.

Second Maxilliped.—Basipodite has only 3 setae. Endopodite has only 4 segments, each of the first 3 of which carries 2 setae and the last 5 as in the preceding appendage. Exopodite is similar to that of the first.

The *Third maxilliped* is in the form of a small rudiment ; the other appendages are absent. Rudiments of 3 gills are also present.

Abdomen.—There are 5 segments and the telson. The last segment is drawn out at its posterolateral angles into two spines. Two smaller spines are present in the same position in the segment in front.

The telson is somewhat different in shape from that of *Emerita*. At its posterior angles there are two large spines between which are arranged on the convex posterior edge 24 smaller spines. There is a small median notch in this edge. Between the spines minute denticles are present as in *Emerita*.

Stage II—Fig. 53.—There is a marked increase in size.

Antennule—Fig. 54.—This is still unjointed and is tipped with 4 aesthetes and two small setae.

Antenna—Fig. 55.—The scale is now bordered with 13 plumose setae.

Mandible—Fig. 56.—This is shown in the figure.

Maxillae.—The first and second maxillae (Figs. 57 and 58) are practically unchanged except for the presence of 11 plumose setae on the scaphognathite.

Maxillipeds.—The first two maxillipeds are likewise in the same condition as they were in the previous stage.

Still only the rudiment of the third maxilliped is present. But it is larger and shows three joints.

Abdomen.—This consists of the same number of segments. The telson also has usually the same number of spines as were present in the last stage ; but in some an additional spine may be present on one side, thus making the arrangement asymmetrical.

Stage III—Fig. 59.—Apart from increase in size, the most important distinguishing characters of this stage are the presence of 8 plumose setae on the exopodites of the first two maxillipeds and the possession of a functional exopodite tipped with 5 plumose setae by the third maxilliped.

Antennule—Fig. 60.—This is still unjointed and bears at its tip the same number of aesthetes and setae as were present in the previous stage. A small additional seta springs from about the middle of the inner margin.

Antenna—Fig. 61.—A rudimentary flagellum has made its appearance in this stage. The scale is unaltered. Besides the spine of the previous two stages a second smaller one has grown opposite to the base of the scale.

Mandible—Fig. 62.—Does not show much change.

First Maxilla—Fig. 63.—The distal endite has 3 stout setae, of which the outermost is not separated by a suture. The palp has 2 unequal setae.

Second Maxilla—Fig. 64.—The scaphognathite has 18 plumose setae, but they are still confined to the anterior part.

First and Second Maxillipeds.—The only development worth mentioning is the increase in the number of plumose setae to 8.

Third Maxilliped—Fig. 65.—This is now biramous. Endopodite is a short unjointed process arising from the base of the basipodite and carries a single short seta at its tip. Exopodite carries 5 swimming setae.

Other thoracic appendages.—Rudiments of all the remaining thoracic appendages have now appeared, that of the last being hidden beneath the one in front. Eight gill rudiments are now present, 3 above each of the first 2 legs and 2 above the third.

Abdomen.—The number of segments remains the same. The spines on the posterior edge of the telson have increased and their number is usually odd, namely, 31 (including the corner spines). In some cases, the odd spine is median in position arising from the notch ; in others it is found on one side. The denticles between the spines have also increased in number.

Stage IV.—The last segment of the abdomen is now differentiated and is provided with uropods. The number of swimming setae in the first 2 maxillipeds has increased to 16 and in the third to 10. The peraeopod rudiments are large and rudiments of pleopods have appeared in abdominal somites 2–5.

Antennule—Fig. 66.—A peduncle is now clearly separated ; but it is unjointed. It bears a few short setae at the distal end of its outer border. There is only one flagellum, which is also unjointed except at the tip where 3 segments are faintly indicated, each of which has 2 aesthetes and the last 2 or 3 setae also.

Antenna—Fig. 67.—The rudimentary flagellum has grown, but it is not as long as the scale. The latter is now bordered with 18 plumose setae.

First Maxilla—Fig. 68.—The distal endite has 4 setae, one of which is much smaller than the others. The proximal endite has several. The palp is unaltered.

Second Maxilla—Fig. 69.—The endites and palp are more or less as they were in the previous stage. The scaphognathite is still without setae at the hinder end.

First Maxilliped.—The fourth segment of the endopodite has a seta on its outer border. The exopodite has 16 swimming setae terminally.

Second Maxilliped.—Endopodite segments 2 and 3 have each a seta on their outer border. Exopodite is similar to that of the first.

Third Maxilliped.—Though slightly grown the endopodite is still shorter than the basipodite and is unjointed. Exopodite is tipped with 10 plumose setae. There is a gill at its base.

Peraeopods.—The peraeopod rudiments are much longer than those of stage III and are obscurely segmented. The extremities of the first and last are already subchelate and chelate respectively. There are 11 well developed gill rudiments above their bases so that their total number in this stage is 12.

Abdomen.—The abdomen now contains six somites and the telson. Somites 2, 3, 4 and 5 have got pleopod rudiments in the form of slender fingershaped processes. The last segment is provided with uropods (Fig. 70) which possess protopodites and exopodites. The latter is long and flat and carries along its inner border and tip 15 plumose setae, of which the 3 at the tip are considerably smaller than the adjacent ones. Endopodite is a minute rudiment.

Telson.—The number of spines on the posterior edge has increased to about 52 but occasionally there is an odd spine. The denticles between them have increased in number and size.

Stage V—Fig. 71.—Specimens belonging to this stage are markedly larger than are those of the corresponding stage of *Emerita*, but the appendages exhibit the same degree of development.

Antennule—Fig. 72.—The peduncle shows the tripartite division of the adult appendage, though not quite clearly. The flagellum is segmented internally, but the segmentation does not show itself above the cuticle. There are 3 more aesthetes than were present in the previous stage.

Antenna—Fig. 73.—The flagellum is as long as the scale, but is unsegmented. The latter is bordered with 22 plumose setae.

First Maxilla—Fig. 74.—This is more or less as it was in the previous stage.

Second Maxilla—Fig. 75.—The palp has 5 setae, 2 of which are at the tip and the rest on the inner margin. The scale is still devoid of setae at the posterior end.

First and Second Maxillipeds.—The second segment of the endopodite of the first and the first segment of that of the second maxilliped have each an outer seta in this stage.

Third Maxilliped—Fig. 76.—The endopodite shows segmentation. Exopodite has 12 plumose setae terminally.

Peraeopods.—The peraeopods are better developed (Figs. 77, 78 and 79) and show all the segments of the adult appendages.

One more gill rudiment has appeared in this stage so that there are altogether 13 gills now on each side. I have not been able to verify this observation by examining a large number of specimens since there were only two in the collection ; nor have I been able to ascertain

whether this observation is in agreement with that of earlier workers since their papers, as has been mentioned in the introduction, were inaccessible to me. In the adult *Albunea* there are only 10 gills, one at the base of the third maxilliped, 2 each for the first four peracopods and one at the base of the last. The possession of a larger number of gills by the larva is therefore a very remarkable phenomenon which, so far as I am aware, has not been recorded till now in other species. Indeed Gurney has remarked that " the gill formula of the larva, with scarcely an exception throughout the Decapoda, is less complete than that of the adult, and furnishes no evidence at all of Recapitulation." In the allied form *Emerita* the last larval stage possesses only 8 gills, one less than the adult number. The present case is therefore a very interesting exception which, I venture to think, could be explained only by invoking the aid of the theory of Recapitulation.

Abdomen.—The first segment is still without pleopods, which are now two jointed structures (Fig. 80) but are not biramous.

Uropod—Figs. 81 *and* 82.—The number of setae on the exopodite has increased to 25, 18 being on the inner margin, 3 at the tip and the rest at the distal end of the outer margin. As in the last stage those at the tip are much shorter than the adjacent ones on the inner margin. The setae on the outer border are not plumose. The endopodite is still rudimentary.

Telson.—The telson is practically unmodified.

Tribe GALATHEIDEA.

Family PORCELLANIDAE.

? Petrolisthes sp. (I).

The first stage corresponds to the figures of the first stage of *Porcellana* given by Webb and Williamson. Though there is no definite evidence to prove that the later stages described below are successive stages, the degree of development of the peracopods in each stage lends some support to such a supposition. Only three stages were obtained, the last of which moulted into the first post-larval stage so that there seem to be only three zoeal stages for this species.

Stage I—Fig. 83.—The rostrum is about 7 mm. long while the posterior spines are only 1·5 mm. long. The former is hexagonal in cross section, at the angles of which there are minute spines. Each of the posterior spines has 5 or 6 small teeth in the proximal half of their inner border. The animal is transparent with bright red chromatophores on the ventral side near the mouth. The first two abdominal segments are also slightly tinged with red.

The stalked eyes are fully developed, but are not free, being fused with the anterior border of the carapace.

Antennule—Fig. 84.—This is an unjointed process bearing at its tip 2 large aesthetes and 3 setae.

Antenna.—There is an unsegmented basal portion which carries two styliform processes. The inner of these is shorter and thicker than the outer and bears a single small seta at its tip. The outer has 3 setae distally.

Mandible—Fig. 85.—As shown in the figure.

First Maxilla—Fig. 86.—There are two endites, the proximal of which is slightly the smaller and bears 6 short setae. The distal has 9. The palp has 3 long slender setae, 2 of which spring from its tip and the other from the inner margin.

Second Maxilla—Fig. 87.—There are the usual 4 endites, the proximal and the distal of which are larger than the others. The palp is unjointed and carries 8 setae distributed along its inner margin and tip. The scaphognathite is long and narrow and bears 6 plumose setae anteriorly. A much larger seta springs from its posterior end.

First Maxilliped—Fig. 88.—The basipodite is longer than the coxopodite and is armed with 7 setae on the inner side. Endopodite is four-jointed, each of the first 2 joints of which carries 3 setae. The third has a seta on its outer margin also and the last has 6 terminally. Exopodite is two-jointed and bears 4 swimming setae.

Second Maxilliped.—The basipodite has only 3 setae. Endopodite has the same number of segments of which the first and second have 2 setae each, the third has 3 of which one is on the outer margin, and the last has 5 at the tip. Exopodite is identical with that of the first.

Other Appendages.—Rudiments of all the remaining appendages are present (Fig. 89). That of the third maxilliped is biramous and the next has a minute chela at its tip.

Abdomen.—The abdomen is composed of 5 segments and the telson. The first somite is very short, the second and third are longer, but broader than long, and the next two are cylindrical. The fifth has a sharp spine at each posterolateral angle. There are no pleopods.

Telson—Fig. 90.—Roughly spoonshaped, wider in the middle and narrower towards both ends. In the posterior half of each lateral margin it bears 5 plumose setae. In front of these setae on each side there is a sharp spine, between which and the adjacent seta there is the reduced hair-like seta characteristic of the Anomuran zoeae. The posterior end is rounded and carries 2 minute teeth, external to which on each side there is another hair-like seta. On its ventral side there is an anal spine.

Stage II.—The rostrum is about 12 mm. long and the posterior spines about 2 mm. Each of the latter has now 8 teeth on the ventral margin. The rudiments of the thoracic appendages have grown considerably and are imperfectly segmented. Abdominal somites 2, 3 and 4 have tiny pleopod rudiments. The eyes are now completely free and the antero-lateral corner of the carapace is produced into a triangular suborbital spine.

Antennule—Fig. 91.—A peduncle and 2 flagella are now clearly differentiated. The former carries a few plumose setae at its distal end. The outer flagellum is larger than the other and both are unjointed ; the former carries 11 aesthetes and 3 or 4 setae, but the latter is unarmed.

Antenna.—The inner process, which is the flagellum, is now about double the length of the outer. The peduncle shows a small papilla on its inner side, which later on becomes perforated by the excretory duct.

Mandible.—The mandible is hardly changed.

First Maxilla.—The endites have grown and the number of setae on them has also increased.

Second Maxilla—Fig. 93.—The setae on the endites have increased in number as in the first maxilla. The palp is unaltered, but the scale has 24–25 plumose setae one of which, arising from the posterior end, is much larger than the others.

First Maxilliped.—The first 2 joints of the endopodite have each a long seta on the outer border and the third has 2 in the same position. The swimming setae on the exopodite have increased to 11.

Second Maxilliped.—The second segment of the endopodite has one and the third 2 outer setae. Exopodite is similar to that of the preceding appendages.

Third Maxilliped—Fig. 94.—There is an unjointed protopodite. The endopodite is shorter than the exopodite and is indistinctly segmented. The latter is two-jointed and bears 6 plumose setae.

Peraeopods.—All the peraeopod rudiments are now much longer and are obscurely jointed. Five gill rudiments have also made their appearance, 2 above the cheliped and 1 above each of the succeeding three appendages.

Abdomen.—The number of segments remains the same. Segments 2, 3 and 4 have uniramous pleopod rudiments. The telson has now 12 plumose setae, the 2 new ones arising from the posterior end between the 2 teeth.

Stage III.—The rostrum is now 16 mm. long and the posterior spines slightly more than 2 mm. The body shows a well marked increase in size and the rudiments of the peraeopods and pleopods are better developed and clearly segmented.

Antennule—Fig. 95.—The peduncle is swollen at the base, but contains no statocyst. An indistinct division into three segments can be made out beneath its cuticle. Two additional plumose setae have developed on the outer side of the swollen portion. The flagella remain unaltered.

Antenna—Fig. 96.—The flagellum shows 2 segments at its base. Otherwise there is no change.

Other Appendages.—The mandible is in much the same condition as in the previous stage. The two maxillae also show no development worth recording. The 3 maxillipeds are also practically unchanged. The rudiments of the other appendages are larger and segmented (Figs. 97, 98 and 99). The last is small and remains hidden below the fourth.

Gills.—The number of gill rudiments has increased to 6.

Abdomen.—The first and last segments are still without pleopods. Each pleopod (Fig. 100) is a uniramous finger-shaped process, obscurely divided into two. The telson is unaltered.

First Post-Larval Stage.—The carapace is slightly longer than broad and its front is broadly triangular. The lateral margins of its posterior portion bear a number of teeth of which 3 in the middle are much larger than the others. The newly moulted animal is more or less transparent. Between abdominal somites 1 and 2, 2 and 3, and 4 and 5 there are transversely placed elongated bright red chromatophores. Two small dot like ones are present at the anterior end of the telson.

The eyes are borne on short peduncles.

Antennule—Fig. 101.—There is a peduncle composed of 3 joints, the most proximal of which is swollen and globular. On its outer border towards the distal end there are a few teeth arranged in 2 groups of 4 in each group. At the base of the inner margin there are a few setae. The third joint bears on each side of its distal end a row of 7 plumose setae. Of the 2 flagella, the outer is larger and five-jointed. The first 3 joints bear numerous aesthetes while the fourth and fifth are without them. The inner flagellum is only three-jointed, each joint bearing one or more setae.

Antenna.—The peduncle has 3 joints, the first of which carries the papilla containing the excretory opening. The flagellum is long and slender, made up of about 36 segments each of which has a ring of short setae.

Mandible—Fig. 102.—The crown has 4 small teeth separated from each other by wide spaces. The palp is short and three-jointed, the terminal joint having a number of minute teeth on its anterior border.

First Maxilla—Fig. 103.—The two usual endites are present, each armed with numerous closely arranged short setae. The palp is a small papilla tipped with a short seta.

Second Maxilla—Fig. 104.—Of the 4 endites the two in the middle are much smaller than the others. All are clothed with setae in the same way as in the preceding appendage. The palp is a finger-shaped unjointed process bearing a single seta at its tip. The scale is bordered with numerous fine plumose setae.

First Maxilliped—Fig. 105.—Both the segments of the protopodite are produced inwards into masticatory processes armed with numerous short setae. Endopodite is small, unjointed and unarmed. Exopodite has 2 joints, each bearing a couple of short setae on its outer border.

Second Maxilliped—Fig. 106.—The inner margins of the protopodite joints are setose. Endopodite consists of 4 joints, the distal 2 of which carry numerous long setae which form a tuft stretching backwards and inwards. Exopodite is longer than endopodite and has 2 segments, the proximal of which bears a few short setae along its inner and outer borders while the distal has 6 plumose setae terminally.

Third Maxilliped—Fig. 107.—The protopodite is more or less similar to that of the second. There are 5 segments in the endopodite, the first 3 of which are much flattened, particularly their inner parts. The inner border of the second bears five small teeth. That of the first has only a few long setae, though the outer border has a tooth distally. The third joint is placed at right angles to the second, and the fourth in the same position with respect to the third, so that they constitute 3 sides of an incomplete rectangle. The two last segments carry numerous long setae similar to those of the same parts of the former appendage. Exopodite is two-jointed, slender and unarmed.

Cheliped—Fig. 108.—This is composed of 6 segments, all of which except the first two have long setae on both borders. The carpus has 10 large teeth on its outer margin. The merus has a large tooth at the middle of its inner upper edge and two smaller ones on its outer border. On its lower inner edge there are 5 or 6 small teeth. The inner edges of the fingers of the chela are armed with only a few ordinary setae.

Second, third and fourth Peraeopods.—These are slender and consist of the same number of joints as the first. The third segment of all of them is much longer than the others. The last joint is claw-like, but about as long as the preceding one and all are setose

Last Peraeopod.—It is much reduced and very similar to the corresponding appendage of *Emerita* and *Albunea*.

Gills.—Ten gills are present, 2 at the base of the third maxilliped and of each of the four succeeding appendages.

Abdomen—Fig. 110.—The abdomen is very much flattened dorsoventrally. The first and the fifth segments are without pleopods. The latter (Fig. 109) are biramous consisting of protopodites, exopodites and endopodites. The outer ramus has a fringe of 10 plumose setae, the inner 4 hooks on its inner border.

Uropods.—The exopodites and endopodites are flattened oval structures, the former being slightly longer and are bordered with numerous plumose setae.

Telson.—Each lateral margin of the telson has a notch so as to divide it into a wider proximal and a narrower distal part. In the proximal half, close to each lateral margin, there is a row of slender setae on the dorsal surface. The posterior part is bordered with plumose setae.

The above account discloses certain differences of these larvae from those of *Porcellana*. The posterior horns of the carapace in the present form are much smaller than the anterior, being only about 1/5 in the first and 1/8 in the last stages, whereas in *Porcellana* according to Webb they are about half as long as the rostral spine. The telson of *Porcellana*, judging from Williamson's figures, does not seem to possess the pair of teeth at the hinder end. The last larval stage of *Porcellana*, according to Webb, possesses only two setose exopodites, *viz.*, those of the first and second maxillipeds, whereas here in the second and third stages the third maxilliped has a well developed functional exopodite provided with plumose setae. In this respect the present form differs from *Polyonyx* also in which in the last stage these appendages are described by Faxon as saclike and rudimentary. There are only 3 pairs of pleopods in this form while in *Polyonyx* and *Porcellana longicornis* there are 4. These differences seem to show that we have here the larvae of a different genus. The shape of the front of the carapace and the nature of the carpus of the chelipeds in the first post-larval stage are similar to those of *Petrolisthes* (Henderson) though the dactyli of the ambulatory legs are not short. The larvae are therefore provisionally referred to this genus.

? Petrolisthes sp. (II).

In all the three stages the animals are decidedly smaller than those of the former species. Except for this difference in size, and a few other minor variations noted below, the two resemble each other remarkably closely.

Stage I—Fig. 111.—The anterior horn is 3·5 mm. long and the posterior 0·5 to 0·75 mm. The latter are perfectly smooth without spines or teeth and retain this characteristic in the next two stages also, so that this constitutes one main difference between the two species.

The stalked eyes and the succeeding appendages are almost identical with those of the previous form. The abdomen consists of the same number of segments with the same number of spines. In the telson (Fig. 112) the teeth at the posterior end are not short and blunt as in the first species, but long and pointed.

Stage II.—The length from the tip of the rostrum to the extremity of the posterior horns is 7 mm. The larva is in precisely the same stage of development as the corresponding stage of species I. The eyes are now free.

The antennules, antennae, mandibles and first maxillae are similar to those of the previous form. In the second maxilla the outer border of the scaphognathite is not completely covered by plumose setae, a short length being without them. Exopodites of the first two maxillipeds have 10 plumose setae, but that of the third only 3.

In the abdomen the posterolateral spines of the last somite are much larger than those of the preceding species, and 2 similar but smaller spines have appeared in the fourth somite also, the latter being yet another difference between the two species.

Stage III.—Except the difference in size, there is very little else between this and the same stage of species I. The differences noted in the previous stage exist in this also.

No specimen belonging to the first post-larval stage was present in the collection.

Porcellanella sp.

Stage I.—Fig. 113.—The animal is much bigger than the same stage of the previous species. The length of the rostrum cannot be given since no specimen had it entire. The posterior horns slightly exceed 3 mm. in length. The rostrum has rows of spinules as in the other forms but the posterior horns have only minute ovoid tubercles on them. The carapace is roughly oval in shape and about 2 mm. long.

The eyes are not free from the carapace.

Antennule.—This is similar to that of *Petrolisthes*, but is larger and tipped with 3 aesthetes and 2 setae one of which is large and plumose.

Antenna.—There is a peduncle consisting of 2 segments, the proximal of which has the papilla on which the excretory gland opens. The spiniform process is longer and thinner than the flagellum, and is cut off from the peduncle by a suture. It has 2 or 3 short setae while the flagellum has only one just below the tip.

Mandible.—This appendage is very similar to that of the larvae described above.

First Maxilla—Fig. 114.—Two setose endites and a palp are present as usual. The latter has 4 terminal setae, 2 of which are much smaller than the others.

Second Maxilla.—The usual 4 endites clothed with setae are present. The palp has 4 setae on the inner border and 4 more towards the tip. The scaphognathite has 8 plumose setae anteriorly and a single large one at the posterior end.

First Maxilliped—Fig. 115.—The coxopodite is extremely short and unarmed, the basipodite is long and bears 6 setae on the inner border. Endopodite is composed of 4 segments as in the previous larvae the first three of which have 3 setae each. The third has, in addition to these, 2 more at about the middle of the inner margin. The last has 6 setae terminally and a single plumose seta on its outer border. Exopodite is two-jointed and carries 4 swimming setae.

Second Maxilliped.—Basipodite has only 2 setae. Endopodite has the same number of segments, of which the first has one, the second 2 and the third 3 setae, one of which is in the middle of the inner margin. The last joint has 5 terminal setae and an outer plumose seta. Exopodite is similar to that of the first.

Other Thoracic Appendages.—Rudiments of all the other thoracic appendages are present, but are small.

Abdomen.—Only 5 segments besides the telson are present as in the other genera. The fifth is much longer than the others and has a pair of large posterolateral spines. The fourth also has a pair of similar but smaller spines.

Telson—Fig. 116.—This is much wider, the breadth between the lateral spines being much more than its length. The lateral margins are armed with the same number of setae and spines as in *Petrolisthes*. The posterior end is perfectly straight without spine or teeth. There is an anal spine.

Stage II.—The carapace is about 3 mm. long and the posterior horns are fully twice as long as those of the first stage.

The stalked eyes are now completely free.

Antennule—Fig. 117.—A peduncle and 2 flagella are now separated as in the previous two species. The former is unjointed, slightly swollen at the base and tipped with a few short setae. The inner flagellum is a small finger-shaped process which is unjointed and unarmed. The outer is larger, obscurely segmented and provided with numerous aesthetes and 2 or 3 setae, of which one is plumose.

Antenna.—The peduncle and spiniform process have undergone hardly any change. The flagellum is more than twice as long as the spiniform process, but is unsegmented.

Mandible.—There is a rudimentary palp now.

First Maxilla.—The endites have several and the palp one more setae than in the previous stage.

Second Maxilla.—The scale is now completely fringed with plumose setae on its outer margin.

First Maxilliped.—Segments 1 and 2 of the endopodite have each a seta on the outer margin. The third has two such setae. The last segment has now 7 terminal setae. The number of swimming setae has increased to 16.

Second Maxilliped.—Endopodite segments have the same number of outer setae as are present in the first. Exopodite is also similar to that of the first.

Third Maxilliped.—This is a biramous rudiment, with the rami unsegmented and unarmed. In this respect this larva resembles the larvae of *Porcellana* and *Polyonyx*.

Peraeopods.—The peraeopod rudiments have not grown much. Rudiments of 6 gills have also appeared.

Abdomen.—All the abdominal somites except the first have small uniramous pleopods.

Telson—Fig. 118.—The most important character of the telson of this stage is the presence of a median plumose seta at its posterior end, and in this respect it differs from all other species. Dohrn, Claus and Cano (as reported by Williamson) have also described larvae showing the same characteristic, but whether they belong to *Porcellana* is doubtful. The lateral setae of the previous stage also persist.

Stage III.—Only one specimen belonging to this stage was obtained from the plankton and in order to get the first post-larval stage this was allowed to moult which it did on the sixth day. But the cast off larval skin was preserved and hence it is possible to indicate the extent of development attained in this stage.

The length of the larva from tip of rostrum to hinder end of posterior horns is 30 mm., a comparatively gigantic size. The rostrum itself measures 21 mm. and the posterior horns 5 mm. The cephalic and the anterior thoracic appendages seem to have advanced but little since the previous stage. The swimming setae on the exopodite of the first 2 maxillipeds are still 16 in number. The third maxilliped and the peraeopod rudiments have grown and the latter are in much the same condition as those of the same stage of *Petrolisthes*.

The pleopods are larger than those of the previous stage, but are still uniramous. The telson is unaltered.

First Post-Larval Stage.—The animal is transparent with bright red chromatophores on the carapace, legs and abdominal somites. The lateral margins of the carapace are serrated, except at the posterior end, and carry a few setae. The front is broadly triangular with a few small teeth at the apex.

Eyes—Fig. 119.—The peduncles are short and thick and the cornea is terminal. At the lower border of the latter on the outer side there is a short blunt tooth and a couple of small setae.

Antennule—Fig. 120.—The first segment of the peduncle is enormously swollen and hollowed out. The second segment articulates with it at its distal inner angle. This and the third are more or less cylindrical. The distal border of the globular part is armed with a few teeth and spines as shown in the figure. The other segments have only setae. The outer flagellum consists of 6 segments, the first 4 of which have on their inner border numerous aesthetes. The remaining 2 have only ordinary setae. The inner flagellum is smaller and is made up of 4 segments, each of which is armed with a few setae.

Antenna—Fig. 121.—The flagellum consists of numerous segments each having a ring of short setae. The first segment of the peduncle has a three-pronged flat spine as shown in the figure. The second segment has a few small tubercles.

Mandible—Fig. 122.—The crown has a smooth convex cutting edge. The palp is three-jointed, the distal joint being armed with a number of short setae on its anterior border.

First Maxilla—Fig. 123.—The two endites are thickly setose. The palp is two-jointed with the distal joint tipped with a single seta.

Second Maxilla.—This is similar to that of *Petrolisthes* except with regard to the palp which has 5-6 setae.

First Maxilliped—Fig. 124.—Protopodite is similar to that of the previous genus, endopodite is an unarmed papilla, while exopodite is two-jointed, each joint having a few short setae.

Second Maxilliped.—This resembles that of *Petrolisthes* closely.

Third Maxilliped—Fig. 125.—This is also more or less similar to that of the preceding form. The third joint of the endopodite is not expanded inwards. Exopodite is a finger-shaped process without any setae.

Cheliped—Fig. 126.—The first two segments are shorter than the others. The merus, carpus and propodus are armed with several spines as shown in the figure. The inner margins of the fingers have only setae.

Peracopods.—The first, second and third ambulatory legs are similar in all respects and are made up of the same number of segments as the cheliped (Fig. 127). The first two segments are short. The third and the fifth are equal and longer than the others. The dactylus is short, stout and clawlike. On its inner edge there are 3 short thick spines. A similar spine is present at the extremity of the inner margin of the propodus also.

The last leg is chelate and small.

Abdomen.—Abdominal segments resemble those of *Petrolisthes.* There are 4 pairs of pleopods. Each is biramous and the parts are flattened and lamellar. Exopodite has 16 swimming setae and endopodite 2 plumose setae and 6 hooks.

Uropods and telson are similar to those of *Petrolisthes.*

The character of the three pairs of ambulatory legs, particularly of their terminal joints, the spines of which may possibly be rudiments of additional claws, are those of *Porcellanella* (Henderson). I have therefore referred these larvae to it.

Other Porcellanids.

Besides the larvae described above, a few other specimens which are obviously *Porcellanids* are also present in the collection. In no case is the series complete and since no post-larval stage of any of them is available they cannot be identified. Nevertheless brief accounts of them are given below in the hope that these will be interesting in so far as they illustrate the extent of variation among the larvae of this family.

Form 1.—Only a few specimens belonging to the first stage are present.

The length from tip of rostrum to extremity of posterior horns is 10 mm. The former is 6.5 and the latter 2 mm. long. Rows of spinules are present on the rostrum. On the posterior horns there is a long slender tooth at the base of the ventral edge and beyond it numerous small teeth (Fig. 128). About a third of their length from the posterior end is practically devoid of them. Along the dorsal edge there are minute tubercles. Two teeth are present at the posterior end of the lateral margin of the carapace also.

The eyes and other appendages do not show any variations worth mentioning. Only the last abdominal segment has postero-lateral spines. The telson is similar in shape to that of *Petrolisthes*, but has not the posterior teeth.

Form 2.—A single specimen belonging to the first stage alone is present. It is very similar to the previous form. The posterior horns (Fig. 129) are longer, being about 3 mm. in length and the long spinelike tooth present in the former is absent here. Otherwise they are similar. The fourth abdominal somite also has a pair of postero-lateral spines.

Form 3.—The earliest stage of this is absent from the collection. The total length of an animal belonging to the second stage is 14 mm. The rostrum is 8 mm. and the posterior horns are 3.5 mm. long.

The rostrum differs from that of all the previous forms in an interesting manner. Instead of rows of spinules there are about 10 rows of teeth of peculiar shape. They are flat and lamellar with straight edges as shown in the figure (Fig. 130). The posterior horns bear on the proximal half of their ventral side a few rows of minute conical tubercles.

The cephalic and thoracic appendages are very similar to those of the same stage of *Petrolisthes*. The mandible has no palp. The third maxilliped has a functional exopodite tipped with 4 plumose setae. Abdominal somites 2-5 have got pleopod rudiments. Only the last segment has got postero-lateral spines. The telson (Fig. 131) is similar to that of the same stage of *Petrolisthes*. The lateral margins bear the same number of plumose setae and spines, but the teeth and reduced setae of the hinder end are absent. Stage III does not show much difference from the preceding except in the better development of the peraeopods and pleopods.

Tribe PAGURIDEA.

Family PAGURIDEA.

Spiropagurus spiriger, De Haan.

Stage I—Fig. 132.—The carapace is short and more or less oval in shape. Anteriorly it is produced into a long and pointed rostrum which reaches beyond the tips of the antennules. Posteriorly it is concave in the median line and drawn out into a short downcurved tooth on each side.

The body has a pale yellowish green colour. At the base of each eye there is a small red chromatophore and two large irregular ones are present on the ventral side close to the mouth. A pair of small branching red and yellow chromatophores is present in the median posterior part of the carapace while a much larger one is placed at about the middle of each side. The telson and the fifth abdominal somite have also chromatophores of the same colour.

The eyes are fused with the carapace.

Antennule—Fig. 133.—This is an unjointed process bearing a single plumose seta a little below the tip, and terminally two aesthetes and 2 or 3 small setae.

Antenna—Fig. 134.—A peduncle, scale and flagellum are present as usual. The first of these bears a large spine at the base of the flagellum. The scale has a terminal spine and 9 plumose setae on the inner margin, the one adjacent to the spine being the smallest. The flagellum is much shorter than the scale and is terminated by 2 plumose setae.

Mandible—Fig. 135.—This is as shown in the figure.

First Maxilla—Fig. 136.—Of the two endites the proximal has 6 short setae and the distal, which is narrower, has 2 stout setae which are not separated by sutures. The palp seems to be three-jointed, the second joint having one and the last 3 setae.

Second Maxilla—Fig. 137.—The usual 4 endites armed with setae are present. The palp has 6 setae of which 3 are terminal and the rest on the inner margin. The scale is short and narrow and has 5 plumose setae.

First Maxilliped—Fig. 138.—Coxopodite is very short. Basipodite bears 9 setae on its inner side. There are 5 segments for the endopodite, the first 2 and the fourth of which are armed with 2 setae each. The third has only one, and the last 4 terminally and 1 on the outer border. On the outer margin of the first 3 segments a number of very fine elongated threadlike setae are present. Exopodite is two-jointed and carries 4 swimming setae.

Second Maxilliped.—Basipodite has only 3 setae. Endopodite has only 4 joints, the first 3 having 2 setae each and the fourth being quite similar to the last segment of the endopodite of the preceding appendage. Segments 1 and 2 have setae on their outer margins similar to those of the former limb. Exopodite is identical with that of the first.

The third maxilliped is a small rudiment and behind it the rudiment of the first peraeopod is also present.

Abdomen.—The abdomen consists of 5 somites and the telson. The posterior edge of the tergum of these somites has 2 minute teeth in the middle, and the fifth has a pair of sharp postero-lateral spines also.

Telson—Fig. 139.—The telson, excluding its anterior portion representing the sixth segment is broadly triangular, the breadth at the hinder end being almost half as much again as its length. In this character it is strikingly different from that of *Eupagurus* and *Spiropagurus chiroacanthus* (Williamson's figures). In this form, however, the posterior edge is not so markedly convex as that of the abovementioned species. Moreover there is a distinct though small cleft in the middle which is absent in the latter. On each side of this median cleft there are 7 spines including the reduced second spine, the fourth of which is the largest. It is ciliated as the others, in which character also the telson differs from that of *Eupagurus*.

Stage II.—The animal is unaltered in shape and appearance. The eyes are free.

Antennule.—The large plumose seta now springs from a small papilla and opposite to its base on the outer side there are 2 or 3 very short setae.

Antenna.—The peduncle has developed a second smaller spine opposite to the base of the scale. The flagellum and the scale are unaltered.

Mandible.—The teeth are larger.

First Maxilla—Fig. 140.—The proximal endite shows hardly any development. The distal has two more setae, the original 2 being still without basal sutures. This condition is retained in the subsequent stages also. The palp has a small seta on its first joint also.

Second Maxilla.—The scale has now 7 plumose setae.

First Maxilliped.—Endopodite segments 1 to 3 have each a long seta at the distal end of the outer border. Exopodite bears 6 swimming setae.

Second Maxilliped.—Segments 2 and 3 of endopodite have each a long seta at the middle of their outer margin. Exopodite is similar to that of the first.

Third Maxilliped—Fig. 141.—There is a protopodite and a well developed functional exopodite tipped with 6 plumose setae. Endopodite is a small rudiment with 2 small terminal setae.

Peraeopods.—Rudiments of all the peraeopods are present, that of the fifth being hidden under the fourth. No gill rudiments have yet appeared.

Abdomen.—The number of somites remains the same. An additional pair of spines has developed in the middle of the posterior edge of the telson so that there are now 8 on each side.

Stage III.—The appearance of the uropods and the increase in the number of swimming setae to 8 are the two most important points of development in this stage.

Antennule.—A peduncle and 2 flagella are now differentiated. The former is unjointed and carries 2 large plumose setae at its distal end. The outer flagellum bears 3 aesthetes and 3 setae at its tip. The inner is considerably smaller and is tipped with a single plumose seta.

Antenna.—The flagellum has elongated and equals the scale in length, but is unjointed and devoid of the setae present in the previous stage. The scale does not show any advance on that of the previous stage.

Maxillae.—The first and second maxillae are unchanged.

Maxillipeds.—In the first and second maxillipeds the exopodites are provided with 8 swimming setae.

The third maxilliped remains unaltered.

Peraeopods.—The peraeopod rudiments have grown and show an obscure segmentation. The first is already chelate. No gill rudiments are yet developed.

Abdomen.—The sixth somite is now cut off from the telson. Pleopods are still absent, but the uropods have made their appearance. Each of the latter (Fig. 142) has a well developed exopodite which is not jointed off from the protopodite. It is long and narrow and terminates in a spine. On its inner margin there are 6 plumose setae. Endopodite is only a minute rudiment.

The telson is similar to that of the previous stage. The fourth spine does not show any sign of reduction as in *Spiropagurus chiroacanthus*.

Stage IV.—This is the last zoeal stage and its distinguishing character is the presence of pleopods on abdominal somites 2 to 5.

Antennule—Fig. 143.—The peduncle is swollen at its base. The outer flagellum has a group of 4 aesthetes at the middle of its inner side. The inner shows no development.

Antenna—Fig. 144.—The flagellum is longer than the scale and consists of 2 segments, the proximal of which is much shorter than the other. The scale has the same number of plumose setae.

Mandible.—This is still without a palp.

First Maxilla.—The distal endite has 5 setae now.

Second Maxilla—Fig. 145.—There is a narrow posterior lobe to the scale which is without setae, a feature characteristic of the Paguridea. The front lobe is bordered with 10 plumose setae.

The first 2 maxillipeds remain unmodified.

Third Maxilliped.—The endopodite has elongated and shows segmentation indistinctly. Exopodite has 8 swimming setae.

Peraeopods.—The peraeopods are well developed and are jointed. There are now 5 gill rudiments, one above the base of each of the first 3 peraeopods and the remaining 2 above the fourth. The second and third are distinctly bifid at their tips.

Abdomen.—Somite 1 is apodal ; 2 to 5 have well developed pleopod rudiments. Each is a biramous appendage in which the endopodite is much the smaller branch (Fig. 146). Both the rami are unjointed and unarmed.

Uropods—Fig. 147.—Exopodite is now cut off from the peduncle by a suture. Endopodite has lengthened a little and is tipped with a single plumose seta.

Telson.—The telson has all the spines of the previous stage.

Glaucothoe Stage—Fig. 148.—Only a single specimen was available for study, and hence the account given below has necessarily to be incomplete.

The carapace shows clearly the 'cervical groove' and the 'linea anomurica.' The rostrum is a very small blunt process.

The eyestalks are somewhat stout and the ocular scales are present.

Antennule.—The peduncle has 3 segments, the proximal of which is much smaller than the others. The inner flagellum is slender and two-jointed with the second joint tipped with a number of setae. The outer has 5 segments, the distal of which is comparatively long. The first four have several aesthetes.

Antenna.—A small narrow vestigial scale and a slender jointed flagellum are present. Each joint of the latter has a ring of setae at its distal end.

Mandible.—In this stage it has a jointed but unarmed palp.

First Maxilla.—There is nothing specially deserving mention.

Second Maxilla.—The palp has a small seta at its tip. The scale has plumose setae all along its border.

First Maxilliped—Fig. 149.—The protopodite segments are expanded inwards into masticatory processes armed with short setae. Exopodite and endopodite are indistinctly jointed and unarmed.

Second Maxilliped—Fig. 150.—Endopodite is five-jointed and bent at right angles at the junction of the second and third joints. Exopodite is two-jointed and armed with 6 plumose setae.

Third Maxilliped.—Endopodite is very short, but bent as in the previous case. Exopodite is similar to that of the preceding appendage.

Chelipeds.—The chelipeds are equal.

Peraeopods.—The next 2 peraeopods are long and slender with elongated clawlike dactyli. The fourth is sub-chelate and the fifth chelate. Both these appendages are much smaller than the anterior pairs.

Gills.—Only 6 gills could be clearly made out.

Abdomen.—Segments 2 to 5 have pleopods. Each pleopod has a peduncle and 2 rami (fig. 151), the outer of which is bordered with 12 plumose setae. The inner is a papilla with 2 hooks at its extremity. The last pair is much smaller and their exopodites have only 8 swimming setae.

Uropods.—Exopodite is large and flattened, carrying a number of setae along its margins and a few lameller teeth on the distal half of its outer border. Endopodite is much smaller.

Telson.—The posterior edge is distinctly convex and resembles on the whole that of *S. chiroacanthus.*

The characters on which the identification of these larvae is based have been indicated in the preceding account and need not therefore be summarised here. They apply, however, only to the genus. As for the species, only *S. spiriger* has been recorded by Henderson from the Madras Coast and hence I have ascribed these larvae to it.

Diogenes ? pugilator, Roux.

Stage I—Fig. 152.—The carapace is more or less similar in shape to that of *Spiropagurus* described above. The rostrum, however, is not so long. Posteriorly the angles are rounded and do not have the characteristic spines of the other form. Though the several stages of this species have been described by Gurney (1926) it seems desirable to give an account of them here also. Size 1.25 mm.

The eyes are fused with the carapace.

Antennule—Is an unjointed process similar to that of *Spiropagurus* with a long plumose seta near the apex and 3 aesthetes and a couple of setae terminally.

Antenna.—This appendage is also very similar to that of the previous species. The flagellum has 2 long terminal setae and just behind the tip another smaller one directed outwards almost at right angles to the scale. The latter has 10 plumose setae besides the terminal spine, the seta nearest the latter being the smallest in this case also.

Mandible—Is more or less similar to that of the previous form.

First Maxilla.—The distal endite is armed exactly in the same way as that of the same stage of *Spiropagurus.* The palp has only a single seta.

Second Maxilla.—The usual 4 endites are present. The palp is unjointed and terminated by 2 setae. The scale has 5 plumose setae.

First Maxilliped.—Coxopodite is unarmed. Basipodite has 5 setae on the inner margin. Endopodite is five-jointed of which segments 1, 2 and 4 have each 2 setae while segment 3 has only one. The last segment has 4 terminal setae and one on the outer margin. Exopodite is two-jointed bearing 4 plumose setae.

Second Maxilliped.—Basipodite has only 2 setae. Exopodite is similar to that of the first. Endopodite is only four-jointed, the first 3 joints of which have 2 setae each and the fourth 5 arranged as in the previous case.

Third Maxilliped.—This appendage is only an elongated rudiment. Behind it there are rudiments of 3 pairs of peraeopods.

Abdomen.—There are 5 somites and the telson. The last 3 somites have small median dorsal spines at their posterior end. Somite 5 has a pair of posterolateral spines.

Telson.—This is broadly triangular, with a distinct though small notch at the middle of the posterior edge. On either side of this there are 7 spines including the reduced hairlike one, of which the fifth is the largest.

Stage II.—In general appearance the larva is unchanged. Exopodite of the first 2 maxillipeds have 6 swimming setae and the third maxilliped has become functional. The telson has 8 spines on each side.

The eyes are now free.

Antennule.—As in the corresponding stage of *Spiropagurus* the plumose seta now springs from a small papilla which would eventually become the inner flagellum and opposite to it there is a couple of setae.

Antenna.—The peduncle has one more spine.

Mandible.—A few small additional teeth have appeared on the cutting edge.

First Maxilla.—The distal endite has 4 setae similar to those of *Spiropagurus*. The palp has 2 setae, one terminal and the other some distance behind.

Second Maxilla.—The second maxilla is unaltered.

First Maxilliped.—Segments 1–3 of the endopodite have outer setae. Exopodite has 6 plumose setae.

Second Maxilliped.—Only the third segment of the endopodite has developed an outer seta. Exopodite is similar to that of the first.

Third Maxilliped.—Exopodite is well developed and functional, having 6 plumose setae. Endopodite is a knob springing from the base of the basipodite.

Peraeopods—Rudiments of all peraeopods are now present.

Abdomen.—The number of segments remains the same. An additional pair of spines has appeared in the middle of the hinder edge of the telson (fig. 153).

Stage III.—In size these animals are much bigger than those described by Gurney, being about 2·25 mm. in length. The most important development which has taken place in this stage is the differentiation of the sixth abdominal somite and the appearance of the uropods.

Antennule.—A peduncle and 2 flagella are now clearly marked out. The former bears a few setae at its distal end. The inner flagellum is hardly more than a knob tipped with a seta. The outer is larger and has 4 aesthetes and 3 or 4 setae.

Antenna.—The flagellum is a stout unjointed process about as long as the scale and bearing a short seta at its tip. The scale has 12 plumose setae on its inner edge.

Mandible, Maxillae and first 2 Maxillipeds.—These are in much the same condition as they were in the previous stage. In the third maxilliped the exopodite is unchanged but the endopodite has grown to some extent.

Other Thoracic Appendages.—Rudiments of the remaining thoracic appendages are also slightly more developed. Gills have not yet appeared.

Abdomen.—All the 6 segments are now present. Pleopod rudiments have not yet appeared but uropods are present. Each of the latter (fig. 154) has a peduncle and a well developed exopodite almost as long as the telson. It has a long terminal spine and 8 plumose setae on the inner margin. Endopodite is a small rudiment.

Telson.—The breadth is now greater than the length. The number of spines in the posterior edge has fallen to what it was in the first stage namely 7 + 7. Gurney explains this reduction by supposing that the median pair which appeared in the previous stage has been lost. An examination of the comparative size of the spines does not support this view. In the two previous stages the largest spine of each side was the fifth from the outside. In this stage, however, this spine is fourth in position. As there is no reason to believe that the largest spine of this stage is not the same as the largest of the previous stages this apparent change of position can be explained only by supposing that the fourth spine of the previous stage has disappeared. There is concrete evidence also for this view. Under sufficient magnification a minute vestige of this spine can clearly be made out in the space between the third and the fifth spines (fig. 155). In closely allied forms also, which are described later on, such vestigial structures of various sizes have been found to occur. Therefore the alteration in the armature of the telson which takes place during the moult from the second to the third stage is thus similar to what has been recorded in the case of *Spiropagurus chiroacanthus* and some species of *Eupagurus* in so far as in all these cases it is the fourth spine that is involved in it.

Stage IV.—The larva has not grown in size. The appearance of pleopods in abdominal somites 2 and 3 is the distinguishing character of this stage.

Antennule.—The inner flagellum has elongated a little.

Antenna.—The flagellum is now longer than the scale and one segment is differentiated at its base as in *Spiropagurus.*

Mandible.—A rudimentary palp has developed.

First Maxilla—This is unaltered.

Second Maxilla.—The scale has now the characteristic posterior lobe devoid of setae. Maxillipeds 1 and 2 are unaltered.

Third Maxilliped.—The endopodite has grown still further and is jointed, though not very distinctly.

Peraeopods.—All the peraeopod rudiments have also grown considerably and show all the segments of the adult limbs.

Gills.—Rudiments of 6 gills are present, one above the third maxicliped and the others above the peraeopods.

Abdomen.—Segments 2 and 3 have got uniramous unjointed pleopod rudiments. Gurney has already shown that in the possession of only 2 pairs of pleopods, this form differs from all other Pagurids.

Uropods.—Only the endopodite shows growth, but it does not bear setae.

Telson.—The telson is similar to that of the previous stage.

Glaucothoe Stage.—Length about 1·5 mm. Several specimens belonging to this stage were obtained from the plankton and one was obtained in the laboratory from a specimen of the last zoeal stage. They all agree very closely to Gurney's description. It is not probable, however, that all the plankton specimens belong to the species *D. pugilator*, since several species of the genus have been recorded from this coast by Henderson, though strangely enough *D. pugilator* is not mentioned by him. As a detailed description of the same stage of *S. spiriger* has been given above. I do not propose to describe the appendages of the present form fully as the differences between the two are not very important. But a few points in which they differ from Gurney's single specimen have to be dealt with here.

The ocular peduncles are short in the Madras specimens also ; but a well defined pair of ocular scales are present in all these forms (fig. 156) though in the specimen from the Bitter Lakes they are reported to be absent. Since this character is shared by all the specimens in my collection, all of which may not belong to the same species, it is just possible that in specimens from the former locality also they may be discovered if better preserved specimens are examined.

The rest of the cephalic appendages and the first three thoracic appendages are somewhat similar to those of *Spiropagurus*. Exopodite of the first maxilliped (fig. 157) has 3 plumose setae and those of the others 6.

The chelipeds are asymmetrical, the left being much larger than the others. The second and third peraeopods are long and slender. The fourth is subchelate and the fifth chelate.

Abdominal somites 2 and 3 alone have pleopods as in the last stage. Each pleopod is a uniramous two-jointed appendage with 6 plumose setae at its tip. In addition to these on each of the following 2 somites there is a single small fingershaped papilla on the left side (fig. 158). These structures have not been mentioned by Gurney. They are present in every one of the specimens in my collection and therefore seem to be characteristic of the genus. In the collection there was a single older specimen in which the abdomen had lost its segmentation and assumed more or less the character of the adult. In it these papillae are absent, but the 2 anterior pairs of pleopods are still present unaltered. They therefore occur only in the early part of the glaucothoe stage.

The uropods are asymmetrical, that of the left side being distinctly larger than the other, though in the Bitter Lakes specimen Gurney reports them to be symmetrical.

The single specimen which was examined by Gurney and the specimens in my collection differ in some interesting respects and these differences are of course shared by the specimen obtained in the Laboratory from one belonging to the last zoeal stage. Whether these differences are real or not can be ascertained only by examining more specimens from the first locality. Though the species *D. pugilator* is not one of the 8 species of the genus recorded from this coast by Henderson the zoeal stages are identical with those described by Gurney and so I have ventured to regard these also as belonging to the same species, the occurrence of which, it is hoped, may be discovered hereafter.

Diogenes sp. 1.

Stage I—Fig. 159.—In size and appearance the animal is almost exactly like this stage of the preceding species. The only important difference between the two is the presence of a median dorsal spine in only the fifth abdominal segment. It has a pair of lateral spines as in the former.

All the appendages are similar to those of stage I of *D. pugilator*. The first maxilla has 2 terminal setae on the palp. Behind the second maxilliped there are only 2 rudiments namely those of the third maxilliped and the first peracopod.

Abdomen contains the same number of segments. Telson has the same shape and armature.

Stage II.—The advance which this stage shows over the previous stage is exactly similar to that of the previous species. Exopodite of the third maxilliped has only 4 plumose setae in this form. Behind it rudiments of the first pair of peracopods are present.

Telson has 16 spines now as in the previous form.

Stage III.—Exopodite of the third maxilliped has now 6 plumose setae. The sixth abdominal segment and the uropods have made their appearance. The number of spines in the telson is now reduced to 14 as in the preceding species (fig. 160) the fourth having disappeared. But a vestige larger than that of the foregoing species is left behind.

Stage IV.—The animal resembles the corresponding stage of *D. pugilator* so closely that there are very few differences other than those already noted. Endopodite of the uropods is now tipped with 2 plumose setae.

Glaucothoe Stage.—A specimen of this was obtained from an animal of the last zoeal stage. It is almost identical with that of the previous species. The ocular scale, the unpaired pleopod rudiments of the fourth and fifth abdominal segments and the asymmetrical uropods are all present exactly as in *D. pugilator.*

Diogenes sp. 2.

A number of forms of another species belonging to the four zoeal stages are present in the collection. They differ from the preceding two species with regard to the abdomen which in this case is totally devoid of spines (fig. 161). Otherwise individuals of the various stages are closely similar to those that have been already described. In the third stage the vestige of the fourth spine is much bigger than in the 2 previous species (figs. 162 and 163). Endopodite of the uropods in the fourth stage is slightly more developed than that of sp. 1 and may be armed with 3 setae.

The glaucothoe is not present in the collection.

? Clibanarius sp.

Several larvae belonging to the first two and the last zoeal stages together with a single glaucothoe occur in the collection. They probably belong to another genus allied to *Diogenes.*

Stage I—Fig. 164.—Length about 1·8 mm. The last stage is slightly more than 3 mm. so that these larvae are much larger than those of *Diogenes.* In appearance the larva resembles those of *Diogenes* closely. The appendages are also so similar as to make detailed accounts unnecessary. The palp of the second maxilla has 4 setae at the tip. The rudiment of the third maxilliped is much better developed, since the exopodite is distinctly two-jointed though unarmed. Rudiments of all the other appendages are also present.

There are only 5 segments and the telson in the abdomen. The fifth has a pair of small spines dorsally and a pair of lateral spines.

The telson is similar in shape and armature to that of *Diogenes*; but the fifth spine is not so conspicuously larger than the neighbouring ones.

In the subsequent stages the development is parallel with that of *Diogenes* so that it is not necessary to describe each stage separately. In the second stage the number of spines in the telson has increased to 16. No specimen of the third stage was present in the collection. In the fourth stage the telson bears only 14 spines as in *Diogenes* (fig. 165), again the fourth spine having disappeared in the preceding stage. The number of swimming setae on the exopodites of the maxillipeds is 6 in the second and succeeding stages.

In the fourth stage pleopods and uropods are present in the abdomen. There are only 3 pairs of the former on somites 2, 3 and 4, an unusual number in the Paguridea. Nine gill rudiments are present, 2 above the base of each of the first four peraepods and a small one close to the last of these.

Glaucothoe stage.—The carapace is similar to that of *Diogenes*. The eyestalks are rather thick and short and the ocular scales are present as in other forms. The maxillae and maxillipeds are more or less similar to those of the previous genus. Exopodite of the first, second and third maxillipeds bear 3, 4 and 6 plumose setae respectively. The ischium of the endopodite of the second has a prominent down-curved tooth on its inner margin.

The chelipeds are equal. The next two legs are long and slender, the dactyli being much longer than the carpus and propodus together. The fourth leg is subchelate and the fifth chelate. There are 10 gills, one above the third maxilliped and the rest as in the previous stage.

Pleopods are present on abdominal somites 2, 3 and 4. They are uniramous, two-jointed structures with 8 plumose setae in the first and second and 4 in the third. Uropods and telson are similar to those of *Diogenes*.

The identification of these larvae is entirely provisional. As has been pointed out they are closely allied to *Diogenes* larvae. But the presence of three pairs of pleopods and some other differences already indicated seem to show that they belong to another genus. *Clibanarius* is the most common genus in Madras which is closely allied to *Diogenes*. I have therefore tentatively regarded these larvae as belonging to that genus.

Section BRACHYURA.

Tribe OXYSTOMATA.

Family DORIPPIDAE.

Ethusa investigatoris, Alcock.

These larvae are very conspicuous objects of the plankton owing to their enormously elongated rostral and dorsal spines. Lateral spines are absent. A few setae are present along the edges of the posterior groove of the carapace in which the abdomen is lodged.

When kept in glass vessels these larvae usually adhere to the sides of the vessels by means of their dorsal spines which are then directed up, their tips often projecting above the surface of the water.

Stage I—Fig. 166.—Length from tip of rostrum to end of dorsal spine 6·5 mm. The latter is slightly shorter than the former. Small dark red chromatophores are present in the distal halves of both the anterior and posterior spines. One of the same colour occurs at the posterior end of the carapace just above the groove for the abdomen and 2 more in the abdomen, one at the posterior end of the last segment and the other in the middle of the ventral side of the second.

Antennule—Fig. 167.—This appendage is an unjointed process bearing at its tip 2 aesthetes and 3 or 4 short setae.

Antenna—Fig. 168.—Exopodite is slightly longer than the spiniform process and bears a few short setae distally.

Mandible—Fig. 169.—The cutting edge has a large tooth at the ventral end and several small ones towards the dorsal portion. There is no palp.

First Maxilla—Fig. 170.—Of the 2 endites the proximal is much smaller and is armed with 3 setae. The distal has 5. The palp is tipped with 4 setae of varying lengths.

Second Maxilla—Fig. 171.—There are 3 small endites, the first of which is armed with 2 and each of the others with 4 setae. Palp is similar to that of maxilla I. The scaphognathite has 3 plumose setae anteriorly and 2 at the posterior end, one of which is very large.

First Maxilliped—Fig. 172.—Basipodite is much larger than coxopodite and is armed on its inner margin with 4 pairs of setae. Exopodite consists of 2 segments, the distal of which bears 4 swimming setae. Endopodite has 5 segments of which the first, second and fourth have a couple of setae on their inner border and the third only one. The last joint has 4 setae terminally and one on its outer border.

Second Maxilliped—Fig. 173.—Basipodite has only 2 setae. Exopodite is similar to that of the first while the endopodite is a small process tipped with 3 setae.

Third Maxilliped.—The third maxilliped is only a small rudiment.

Abdomen.—This consists of 5 segments and the telson. The first four have each a seta at the posterior end of their dorsal surfaces. The second has a pair of small lateral hooks. The telson (fig. 174) is much longer than the last 2 segments together. Posteriorly it is divided into 2 long tapering forks. Anteriorly on each side it bears a sharp spine and between the 2 forks there are 2 long setae. In the telson of the same stage of *Ethusa macerone* described by Cano (the figure of which is reproduced by Williamson) there are 4 setae and in this respect the 2 species differ.

Stage II.—The length is now 11·5 mm. Colouration is the same.

The antennule (fig. 175) and antenna (fig. 176) have only grown.

The mandible also does not show much change.

First Maxilla—Fig. 177.—The two endites are armed with 5 and 8 setae respectively.

Second Maxilla—Fig. 178.—Endites and palp are unchanged. The scale is now bordered with 12 plumose setae.

First Maxilliped.—Exopodite now bears six swimming setae.

Second Maxilliped—Fig. 179.—Endopodite has grown slightly and is two-jointed, the first joint having one seta and the other three as in the previous case. Exopodite is similar to that of the first. A small epipodite has developed on the coxopodite in this stage.

Other Thoracic Appendages.—Rudiments of all the remaining thoracic appendages have appeared.

Abdomen.—The number of segments remains the same. The first has a long seta on its dorsal side near the posterior end and each of the others two short setae in the same position. The telson has not changed.

Stage III.—There is little change in appearance and the length has increased to 15 mm. Exopodite of the maxillipeds have 12 swimming setae and the rudiments of the thoracic appendages are much bigger.

Antennule—Fig. 180.—It has much the same appearance as in the previous stages, but has grown considerably. There are five aesthetes and a seta at its tip.

Antenna—Fig. 181.—A rudimentary flagellum about a third of the length of the spinous process has made its appearance.

Mandible—Fig. 182.—There is as yet no palp.

First Maxilla—Fig. 183.—The first endite has six and the other ten setae. Palp is unaltered.

Second Maxilla—Fig. 184.—The scaphognathite is bordered with numerous plumose setae.

First and second Maxillipeds.—Protopodites and endopodites are more or less as they were in the previous stage. Exopodites have eight plumose setae terminally and four on the sides. A rudimentary gill also has appeared at the base of the second (fig. 185).

Other Thoracic Appendages.—Rudiments of the other appendages are much better developed then they were in the previous stage (fig. 186). That of the third maxilliped is smaller than the others and at its base also there are rudiments of a gill and an epipodite.

Abdomen.—The first segment has now three setae on its dorsal side.

Stage IV—Fig. 187.—Length 22 mm. The emergence of pleopods and the differentiation of the sixth abdominal segment are the most important characters of this stage.

The proximal parts of the second and the third maxillipeds and the hinder ends of abdominal somites 2 and 3 have a bright pink colour.

Antennule—Fig. 188.—A peduncle and 2 flagella are now clearly differentiated. The former is swollen at the base. The inner flagellum is small and devoid of setae or aesthetes while the outer is much larger and has several aesthetes on its inner side and tip.

Antenna—Fig. 189.—The flagellum has elongated to some extent.

Mandible—Is still palpless.

First Maxilla—Fig. 190.— Is practically unaltered.

Second Maxilla—Fig. 191.—The setae on the 2 distal endites have increased to 6 ; but the first endite persists in the same condition in which it was in the first stage. The palp has 5 terminal setae and the scale is bordered with numerous setae.

First and Second Maxillipedt.—Only the exopodites show development. They carry 10 swimming setae terminally and 3 pairs laterally. A small epipodite is present at the base of the first maxilliped also.

Other appendages.—Rudiments of the third maxilliped and the other appendages show segmentation (fig. 192) though imperfectly. That of the cheliped is chelate. The last 2 pairs are shorter than the rest.

Gills.—Above the base of each of the first four peraeopods there is a gill, so that altogether there are 6 gill rudiments in this stage.

Abdomen.—The sixth somite is now cut off from the telson. The dorsal setae of the first abdominal segment have elongated so much that they stretch far beyond the posterior end of the second abdominal somite. There is a pair of posterolateral spines for the sixth segment. There are only 4 pairs of pleopods, the first and last somites being apodal. Each pleopod is a uniramous fingershaped process. The telson is unaltered except in size.

This stage is the last zoeal stage since specimens belonging to it metamorphosed into the megalopae directly.

Megalopa—Fig. 193.—The animal has a striking resemblance to the adult. The general colour is milky white. At the base of the eye stalk the carapace contains on each side a branching red chromatophore which sends a long branch posteriorly so that each is roughly hammershaped. The first abdominal segment has a similarly shaped but smaller one dorsally. The three distal segments of the ambulatory legs are pink.

The front of the carapace is produced into two broadly triangular processes one on either side of the middle line. Its anterolateral angle is produced into a narrow triangular spine, the base of which, as also that of the frontal process of each side, is separated by a deep cleft. The branchial regions are swollen. The lateral margins are finely serrated.

The optic peduncles are short and thick.

Antennule—Fig. 194.—This folds longitudinally in its fossa. The basal segment is extremely swollen and globular—a characteristic of the species—and bears a few setae. The second and third joints are elongated. The outer flagellum has 5 joints of which the second, third and fourth bear numerous aesthetes. The first and last have no aesthetes, but the latter has 2 setae. The inner flagellum is small and has only 2 joints.

Antenna—Fig. 195.—This consists of 17 segments, the most proximal of which carries a row of small teeth and several setae along its ventral side. Each of the other joints has a ring of setae.

Mandible—Fig. 196.—The cutting edge has few teeth as shown in the figure. A small palp is present.

First Maxilla—Fig. 197.—The same parts as were present in the previous stages are present now also. The proximal endite is much narrower. The palp seems to be two-jointed, the proximal joint having 6 setae and the other 2.

Second Maxilla—Fig. 198.—All the 3 endites of the zoeae are present, the first of which is much smaller. The palp is tipped with only a single seta. The scale is bordered with numerous plumose setae.

First Maxilliped—Fig. 199.—The protopodite is produced inwards into 2 masticatory processes clothed with setae. Endopodite is two-jointed, the proximal joint being armed with setae along its inner border. The distal joint is a long flattened lobe fringed with short setae. These segments of the two sides are very close to each other and project beyond the meropodite of the third maxilliped so as to shut in the anterior part of the buccal channel. Exopodite is also two-jointed, the basal joint having a few ordinary setae and the distal joint all the plumose setae of the last stage.

Second Maxilliped—Fig. 200.—Endopodite is slender and consists of 4 segments. The last segment and the outer margin of the penultimate segment are bordered with several long spines and setae. Exopodite has 2 segments of which the first bears 5 short plumose setae on its outer margin and the other about 10. There is an epipodite and a gill at its base.

Third Maxilliped—Fig. 201.—These are also biramous. The endopodites are flattened considerably and the two meet each other in the mid-ventral line forming a kind of operculum for the mouth in the hinder region. Projecting outwards from the coxopodite there is an

epipodite as shown in the figure. Its dorsal surface projects into the branchial aperture situated just in front of the base of the cheliped and carries 5 rows of short setae along its length. They, together with the setae set on the margins of the aperture, seem to form an effective sieve to keep out solid matter from the branchial chamber. From the posterior border of its distal end arises a two-jointed slender rod which stretches backwards and carries along its length a number of fine thread-like setae. There is a gill and by its side a papilla which may be an undeveloped gill.

Of the 5 joints of the endopodite the ischium and merus bear numerous short setae along their inner border. The remaining three joints are bent inwards and bear long setae on their ventral sides. Exopodite extends forwards parallel to the outer edge of the ischium and reaches up to the middle of the merus. A few spines and setae are borne by it.

Cheliped—Fig. 202.—The chelipeds are equal, short and stout. The merus is long and somewhat flattened dorso-ventrally. The carpus is triangular in shape. The palm is swollen and broad and is not so long as the fingers which are long and pointed and bear several pointed teeth on their inner margin.

Peraeopods.—The second and third peraeopods are long and slender. The meropodite is greatly elongated and equals the carpus and propodus together. The dactylus is long and bladeshaped. All joints except the last bear short setae.

The last 2 peraeopods are much reduced and arise from the dorsal surface as in the adult. The fourth is longer than the fifth since the ischium of the former is almost double that of the latter in length. The merus is the longest joint in both. The propodus is curved and the short clawlike dactylus can be folded against it so that the two together form a grasping organ.

Abdomen.—Consists of 6 somites and the telson. The first segment is without pleopods. The second, third, fourth and fifth have them well developed. Each pleopod (fig. 203) is biramous. The exopodite is unjointed and bordered with 16 plumose setae. The endopodite is a small papilla carrying about 11 hooks on its margin. Towards the posterior segments the pleopods become smaller, but the number of setae remains the same. The last somite is also without pleopods. The telson is small and roughly heartshaped.

Even in this stage the animal exhibits the adult habit of carrying objects above its back for protection. It was noticed that any small bits of substances happening to be in the water in which it was kept, even pieces of muscles of newly moulted *Emerita* with which it was fed occasionally, were carried by it on its back grasped between the terminal joints of the last 2 pairs of peraeopods. It would seem that the creatures were never comfortable without some such protective covering. Due to this habit, in the course of 2 or 3 days the carapace

became covered by a mass of dirt and debris which are present in sea-water taken near the coast. These were, however, removed and the animal was transferred to clean water which accidentally contained a halfshell of a small Lamellibranch. Within a short time the crab was observed to have hoisted it on its back in such a way that it was completely hidden in the hollow of the shell with only the eyes, antennules and portions of the middle pair of legs projecting out. It continued to carry this till it was killed for examination. At this stage therefore it manifests no preference for any particular object, making use of anything that is within its reach.

Family Leucosiidae.

Philyra scabriuscula, Fabr.

Stage I—Fig. 204.—The carapace is highly arched antero-posteriorly, and when looked at from the front side is roughly diamond-shaped. There is a short pointed rostrum and a dorsal spine arising from the middle of the carapace about equal in length to the former. Behind it there is an elongated rectangular cleft through which the abdomen comes out. Lateral spines are not present. There are two short broadly triangular processes at the posterolateral parts of the carapace. In the possession of a dorsal spine this larva differs from both *Ebalia* and *Leucosia signata*.

The eyes are partly fused with the carapace.

Antennule—Fig. 205.—This is a small papilla carrying at its tip two aesthetes and a seta.

Antenna.—No trace of this appendage could be made out.

Mandible—Fig. 206.—The cutting edge has no well developed teeth.

First Maxilla—Fig. 207.—Of the 2 endites the proximal is the smaller. The palp is a short process tipped with 4 setae.

Second Maxilla—Fig. 208.—There are only 2 endites, the proximal one being the smaller. It is armed with 5 and the distal with 7 setae. The palp is unjointed and has 3 setae, 2 at the tip and one on the inner border close to the others. The scaphognathite has 3 plumose setae.

First Maxilliped—Fig 209.—Coxopodite is extremely small. Basipodite is armed with 6 setae. Endopodite consists of 5 segments of which the first, second and fourth have 2 setae each on the inner border and the third one only. The last segment has 4 terminal setae. Exopodite is two-jointed and carries 4 plumose setae.

Second Maxilliped.—Basipodite has only 3 minute setae. Endopodite is very short and obscurely two-jointed with 3 setae at the tip. Exopodite is similar to that of the first.

Other appendages.—Rudiments of all the other appendages are present as small papillae.

Abdomen.—There are 5 segments and the telson. All except the first are nearly equal in length and cylindrical. The second and third have small laterally placed knobs one on each side. The telson is broadly triangular and similar in shape to those of *Ebalia* and *Leucosia*. Its posterior corners are drawn out into long pointed spines. The posterior border is slightly concave and at its middle there are 6 setae. External to the corner spine there are 2 minute teeth and internally one.

Stage II.—Fig. 210.—The eyes are now completely free. The lateral spines appear in the form of 2 extremely short knobs at the lateral angles of the carapace above the triangular processes mentioned previously.

Antennules—Fig. 211.—They have grown slightly and are tipped with four aesthetes and 2 setae.

Antenna.—These appendages have appeared as small papillae at the base of the antennules.

Mandible.—This is practically unaltered.

First Maxilla—Fig. 212.—A seta has appeared on the outer margin of the basipodite close to the base of the palp.

Second Maxilla—Fig. 213.—The endites and palp are more or less similar to those of the previous stage. The scaphognathite has elongated considerably and is bordered with about 15 plumose setae.

First Maxilliped.—The last segment of the endopodite has a seta on its outer margin. Exopodite has 6 swimming setae.

Second Maxilliped.—Except an increase in the number of swimming setae on the exopodite to 6 there is no change.

Other appendages.—Rudiments of the other appendages have grown into finger-shaped processes, those of the chelipeds being already chelate.

Abdomen.—The same number of segments are present in this stage also. Small rudiments of pleopods have appeared on the ventral side of all segments except the first.

Telson.—The telson shows no change.

Stage III—Figs. 214 *and* 215.—The carapace shows some variation in this stage. In some individuals (fig. 214) the rudimentary lateral spines are slightly better developed while in others (fig. 215) they are hardly recognizable. In the latter the triangular processes of the former stages have developed into short blunt processes. These two conditions are not, however, well marked, as intermediate stages are also common.

Antennule—Fig. 216.—A peduncle and 2 flagella are now differentiated. The outer flagellum has got all the aesthetes of the previous stage. The inner is a small papilla.

Antenna.—This has grown in length to some extent.

First Maxilla—Is in much the same condition as that of the previous stage.

Second Maxilla.—Except for an increase in the number of plumose setae on the scaphognathite there is no change.

Other appendages.—The first and second maxillipeds do not show any advance except for the presence of one or two additional setae on the basipodite of the first. The swimming setae are still only 6 in number.

The third maxilliped (Fig. 217) is biramous but does not show segmentation or armature.

The peraeopod rudiments (Fig. 218) are segmented. Five small gill rudiments are also present.

Abdomen.—The number of somites remains the same. The first is without pleopods and has a row of 4 small setae on its dorsal surface. The remaining 4 segments have biramous pleopods (Fig. 219) whose inner rami are extremely rudimentary.

The telson does not show any change.

In *Ebalia* there are 4 zoeal stages, the pleopods appearing in the third stage. Though only 3 stages were obtained of *Leucosia signata* the difference between the first and second stages is so much that Gurney thinks the presence of another stage between the two likely. In *Philyra* there are only 3 stages, as the third stage described above moulted directly into the megalopa.

Megalopa—Fig. 220.—This is about 2 mm. in length. The carapace has several blunt spinous processes differing markedly in this respect from that of *Ebalia*. In front there is a short blunt rostrum, the tip of which reaches to the anterior end of the antennular peduncle. Behind it there is a short blunt spine on either side marking the lateral boundary of the gastric region. Near the posterior border there is a median spine, longer than the former and projecting upwards and slightly backwards. In the branchial region, which is slightly inflated, there is a spine similar to those of the gastric region.

On the ventral side also there are some spines. At the base of the second peraeopod there is a very prominent spine similar to the median dorsal which projects downwards and slightly backwards. Behind it at the base of each of the remaining peraeopods also there is a much smaller tooth-like spine.

The optic peduncles and the last 3 abdominal somites also have chromatophores of a reddish brown colour. On the ventral side at the base of the third maxillipeds and chelipeds also there are chromatophores of the same colour.

Antennule—Fig. 221.—The first segment of the peduncle is swollen. The second is directed forwards and the third downwards. The outer flagellum consists of 4 segments provided with aesthetes. The inner is as long as the outer but is considerably thinner and is not clearly segmented. It is tipped with 3 setae.

Antenna—Fig. 222.—Short and slender having but 6 segments.

Mandible—Fig. 223.—Has still no palp.

First Maxilla—Fig. 224.—The two endites are present as before, but the palp has degenerated.

Second Maxilla—Fig. 225.—There is only a single endite. The palp is unarmed. The scaphognathite has broadened at the anterior part and is bordered with numerous small plumose setae.

First Maxilliped—Fig. 226.—The protopodite segments are produced inwards as usual into masticatory processes. Endopodite is an unjointed lameller structure with 2 small setae near the tip. Exopodite is two-jointed and tipped with 4 plumose setae. An epipodite is present.

Second Maxilliped—Fig. 227.—Protopodite is very short. Endopodite is five-jointed and bent. The last 2 joints have a few short setae. Exopodite is similar to that of the first maxilliped.

Third Maxilliped—Fig. 228.—Protopodite, first 2 endopodite segments and exopodite are flattened. The last-mentioned part is longer than the ischium and has 5 short setae on its outer border. The 3 terminal joints of the endopodite are directed backwards and are concealed for the most part by the inner border of the meropodite. There is a gill at the base of this appendage.

Cheliped.—This consists of 6 segments, the first two of which are very short. The palm is swollen and is somewhat shorter than the fingers, which are slender and have only short setae on their inner edge.

Peracopods.—The remaining 4 pairs of peracopods are all similar. They are shorter than the chelipeds, are slender and consist of the same number of segments. The merus and dactylus are much longer than the others. Setae are practically absent from all joints.

Gills.—There is a gill at the base of each of the first four peracopods.

Abdomen.—Five segments and the telson are present in this stage also. All except the first have pleopods. A few short setae are present on the dorsal side of each somite. The telson is small with a convex posterior margin.

Each pleopod (fig. 229) has a setose exopodite bearing 7 plumose setae. Endopodite is a small papilla with 2 hooks at its end. The number of setae is the same in the last pair also.

? Leucosia sp.

The identification of these larvae is purely provisional.

Stage I—Fig. 230.—The carapace is provided with very well developed rostral, dorsal and lateral spines. The dorsal arises from the middle of the carapace and the laterals are slightly curved downwards so that the three give an unmistakably characteristic shape to the carapace. The cleft on the posterior edge of the carapace is rectangular as in the preceding case, and on either side of its dorsal end there is a small knob.

The eyes are stalked and free from the carapace.

Antennule—Fig. 231.—Is quite similar to that of the same stage of *Philyra.*

Antenna.—Is in the form of a small knob at the base of the antennule.

Mandible.—As in the previous case the cutting edge has no teeth on it.

First Maxilla—Fig. 232.—The endites and palp are similar in shape and armature to those of *Philyra.*

Second Maxilla—Fig. 233.—The endites are as in *Philyra.* The palp has 3 setae at the tip and one at about the middle. The scale is long and has 3 plumose setae at the anterior end and two at the posterior end.

First Maxilliped.—Basipodite is armed with 8 setae. Endopodite is five-jointed. Joints 1, 2 and 4 have 2 setae each, but joint 3 has only one. The last has 4 setae terminally and a small one on the outer margin. Exopodite is two-jointed and carries 4 terminal plumose setae.

Second Maxilliped.—Basipodite has only 3 small setae. Endopodite is a small unjointed rudiment with 3 small setae at its tip.

Rudiments of only the third maxilliped are present in this stage.

Abdomen.—This is composed of five segments and the telson as in the foregoing case. Segments 2 and 3 have small triangular knobs laterally. The telson is similar in shape to that of *Philyra.* At its posterior edge there is a group of 6 setae. The spine at each lateral

corner is very small when compared to those of the previous species. Just on the inner side of this spine there is a minute tooth and 2 similar teeth are present on the outer margin close to the corner spine.

Stage II.—The shape is unchanged.

Antennule.—This has grown and is now tipped with 4 aesthetes and a seta.

Antenna and Mandible.—These show little development.

First Maxilla.—The endites have developed 2 or 3 additional setae. The palp is unaltered. Near the base of the palp on the outer margin there is a single plumose seta.

Second Maxilla.—Endites and palp are practically unaltered. The scaphognathite has now about 16 plumose setae.

First Maxilliped.—A small epipodite has developed on the protopodite. Endopodite is unmodified. Exopodite has 6 plumose setae.

Second Maxilliped.—The only development is the increase in the number of swimming setae to 6.

Other Appendages.—Besides the rudiments of the third maxilliped those of the remaining appendages have also made their appearance. That of the third maxilliped is much thinner than the others. The cheliped rudiment is already chelate. Two gill rudiments above the first two peracopods are present.

Abdomen.—The number of segments remains the same. The first has a row of 3 short setae on its dorsal surface. Segments 2-5 have small knob-like rudimentary pleopods ventrally. The telson is unaltered.

Stage III.—The size has increased slightly. The natatory setae on the exopodites have become 8 in number.

Antennule.—This has grown and one more aesthetes has developed on it.

Antenna.—This has only grown a little.

Mandible and First Maxilla.—These are very similar to those of the previous stage.

Second Maxilla—Fig. 234.—The distal endite is much larger than the proximal as in the previous stages, but its setae are gathered into 2 groups as shown in the figure. The palp has 2 terminal setae and 2 lateral ones. The scaphognathite has numerous plumose setae.

Other Appendages.—The first two maxillipeds and the rudiments of the remaining appendages are in much the same condition as they were in except for the increase in the number of swimming setae on the exopodite to 8.

Abdomen.—There are still only 5 segments besides the telson. The first segment has now 5 setae instead of 3 as in the previous stage. The pleopod rudiments have hardly grown. The 2 setae in the middle of the posterior edge of the telson are now appreciably larger than those of the previous stage.

Stage IV.—There is a marked increase in size.

Antennule.—A peduncle and 2 flagella are now present. The inner flagellum is very short and unarmed. The outer is two-jointed, of which the proximal joint has 4 aesthetes.

Antenna.—A peduncle and a minute flagellum are now distinguishable.

Mandible.—This is still without a palp.

First and Second Maxilla.—These are hardly changed.

First Maxilliped.—The epipodite has grown considerably.

Other Appendages.—The second maxilliped is unaltered. The third maxilliped is biramous, but unarmed. The peraeopod rudiments (fig. 235) are well developed and ointed. Above their base there are 5 gills.

Abdomen.—Only the same 5 somites are still present. The first segment has now a row of 7 setae. It is apodal. The pleopods of the other segments are biramous, with minute endopodites and unarmed exopodites (fig. 236). Though the sixth somite is not cut off, its pleopods are present in the anterior part of the ventral side of the telson (fig. 237). The latter remains unchanged in shape. The middle setae, which showed some growth in the last stage, have elongated still more.

Megalopa—Fig. 238.—This is about 2.75 mm. in length. The carapace differs considerably from that of *Philyra*. The front is broadly triangular. There are not even vestiges of the spines of the carapace which form the most characteristic feature of the megalopa of the previous species. Behind the eyes and between the lateral margins of the carapace and the branchiostegite there is a groove which is wider anteriorly. This probably is the representative of the thoracic sinus of the adult.

On the ventral side at the base of each of the peraeopods except the first there is a tooth recalling the similar structures in the same place of the megalopa of *Philyra*.

The antennules and antennae are more or less similar to those of the first form. The mouth appendages have not been dissected out since there was only a single specimen in the collection. The chelipeds are equal. The other peraeopods are more or less similar to those of the previous form. The dactyli of the last pair are without feelers.

Abdomen.—The abdomen consists of 6 segments and the telson. The first is without pleopods. Each pleopod has a protopodite, a large oval exopodite bordered with about 18 plumose setae and a small endopodite having 3 hooks at its tip. The last pair are much smaller and their exopodites bear only 9 setae.

Tribe BRACHYGNATHA.

Family GONOPLACIDAE.

Gonoplax sp.

Stage I—Fig. 239.—In general appearance it resembles the corresponding stage of *G. rhomboides*. The carapace has long rostral and dorsal spines, but the laterals are comparatively small.

Antennule—Fig. 240.—This is a small conical process with 2 aesthetes at its tip.

Antenna—Fig. 241.—The peduncle, exopodite and spiniform process are all well developed. The two latter are equal in length. The exopodite bears 2 short setae at about its middle and beyond them a few spinules.

Mandible—Fig. 242.—This is as shown in the figure.

First Maxilla—Fig. 243.—The two usual endites are present. The palp seems to be two-jointed, the proximal joint having a single seta and the distal 6.

Second Maxilla—Fig. 244.—There are 4 endites. The palp has 3 setae on the inner border and 6 at the tip. The scaphognathite is narrow, bordered with only 5 plumose setae.

First Maxilliped.—Basipodite is, as usual, much larger than coxopodite and is armed with 7 setae. Endopodite has 5 joints, each of the first two and the fourth of which has 2 setae on their inner border, the third has one and the last 4 terminally and one on the outer border. Exopodite is two-jointed with 4 natatory setae.

Second Maxilliped.—Basipodite has only 4 setae. Endopodite is very small, but consists of 4 joints. The first three of these have one seta each and the last 3 at the tip and one on the outer border. Exopodite is similar to that of the first.

Third maxilliped.—This is a small rudiment.

Abdomen.—There are 5 somites and the telson. The second has a pair of lateral knobs. In the absence of lateral knobs and spines on any of the succeeding segments in this as well as the later stages this species differs from *G. rhomboides*. The telson (fig. 245) is forked with 6 setae between the forks and a spine externally on each side.

Stage II.—Antennule.—This has grown to some extent and carries 4 aesthetes and 2 setae at the tip.

Antenna.—Is unaltered except in size.

First Maxilla—Fig. 246.—The number of setae on the endites has increased. A short plumose seta has appeared on the outer border of the basipodite.

Second Maxilla—Fig. 247.—The scaphognathite is now bordered with 12 plumose setae.

First and Second Maxillipeds.—Exopodites have 6 plumose setae.

Other Appendages.—Rudiments of all of the remaining thoracic appendages are present now.

The abdomen shows no change.

Stage III.—The *antennule* is unaltered.

Antenna—Fig. 248.—A small rudimentary flagellum has made its appearance.

Mandible and First Maxilla—Fig. 249.—These do not show any advance on those of the previous stage.

Second Maxilla.—The scaphognathite has 18 plumose setae now.

First Maxilliped.—The protopodite has now 11 setae on the inner margin, one on the coxopodite and 10 on the basipodite. The swimming setae on the expodite have increased to 8.

Second Maxilliped.—Except in the increase of swimming setae to 8 there is no other change worth mentioning.

Other Appendages.—Rudiments of the other appendages have elongated, but are not segmented ; 3 or 4 gill rudiments have also appeared.

Abdomen.—There are now 6 segments, the last segment having been cut off from the telson. The first segment has 2 slender setae on its dorsal side. The telson exhibits no change.

Stage IV.—The swimming setae on the exopodites have increased to 10 in number and the pleopods have made their appearance.

Antennule—Fig. 250.—A peduncle and 2 flagella are present. The inner flagellum is small ; the outer has 6 aesthetes and a seta at its end.

Antenna—Fig. 251.—The rudiment of the flagellum is about a third of the spiniform process in length.

Mandible.—Fig. 252.—This is as shown in the figure.

First Maxilla.—This shows nothing new.

Second Maxilla.—The scale has about 30 plumose setae.

First and Second Maxillipeds.—Endopodite joint 3 has a seta on the outer border. Exopodite has 10 swimming setae.

Third Maxilliped.—This is now biramous; but the rami are unjointed and unarmed. The protopodite has a small epipodite.

Other Appendages.—Rudiments of the remaining appendages are much bigger than they were in stage III and show traces of segmentation. That of the cheliped shows a rudimentary chela at its tip. There are 5 gills, one above the third maxilliped and the others above the first four peraeopods.

Abdomen.—The first segment has 4 setae dorsally. Segments 2 to 6 have small pleopod rudiments, those of the last being hardly more than rounded knobs.

Stage V.—In *G. rhomboides* there are only 4 stages. In this species there is a distinct fifth stage characterised by 12 plumose setae on the maxillipeds and well-developed pleopods.

Antennule—Fig. 253.—The base of the peduncle is swollen and globular and bears one or two setae. The outer flagellum shows faintly 4 segments.

Antenna.—The flagellum is 2/3 of the spiniform process in length.

Other Appendages.—The mandible and maxillae are similar to those of stage IV.

Exopodites of the first 2 maxillipeds have 12 plumose setae. There is a small epipodite at the base of each.

Exopodite of the third maxilliped is two-jointed and endopodite five-jointed; but both are unarmed.

The peraeopod rudiments (fig. 254) are clearly segmented. The number of gills remains the same.

Abdomen.—The first somite is apodal as in the previous stage. The pleopods have well developed, but unarmed exopodites and rudimentary endopodites.

Megalopa—Fig. 255.—The rostrum is squarish. The carapace has a sharp spine on each side a little behind the eye. The general colour of the animal is greenish brown, but a number of chromatophores of dark red colour are present in various parts. The optic peduncle has one on its posterior side. A median branching one is present near the posterior margin of the carapace. The first and last abdominal segments also have one each on their dorsal sides. The chelipeds and the basal joints of peraeopods 2-4 also contain similar chromatophores.

Antennule—Fig. 256.—The first segment of the peduncle is enormously swollen, as in the previous stage. The second is directed forwards and the third downwards. The inner flagellum is short and two-jointed with the distal joint tipped with a few setae. The outer has 5 segments of which the fifth has no aesthetes, but only 2 setae.

Antenna.—This consists of 11 joints, the first of which has a papilla on its ventral side on which opens the excretory duct.

Mandible—Fig. 257.—There is a distinct palp armed with a few short setae terminally.

First Maxilla—Fig. 258.—The same parts as were present in the zoeal stages are present now also. The palp is two-jointed, each joint having 2 setae. The basipodite has its external seta as in the previous stage.

Second Maxilla—Fig. 259.—This appendage is not much different from that of the zoea.

First Maxilliped—Fig. 260.—The protopodite is produced inwards into masticatory processes armed with setae. Exopodite is two-jointed, the proximal joint having 4 and the distal 6 plumose setae. Endopodite is also two-jointed. An epipodite bearing a few thread-like setae arise from the coxopodite.

Second Maxilliped—Fig. 261.—Protopodite segments are very small. Coxopodite bears an epipodite. Endopodite has 4 segments, the distal 3 of which are bent at almost a right angle with the first. The last two segments bear a number of setae. Exopodite has 2 segments, the distal of which has 6 plumose setae terminally.

Third Maxilliped—Fig. 262.—Protopodite segments are similar to those of the previous appendages. Endopodite is five-jointed; the first two joints are flattened and bear a number of setae along their inner border. The next three segments are bent in the same way as the corresponding segments of the second maxilliped. They also bear setae on their inner border. Exopodite has 2 joints the first of which is nearly as long as the first two segments of the endopodite. The second joint is similar to that of maxilliped II. An epipodite and a gill are present.

Cheliped—Fig. 263.—This is composed of 6 segments, the first 2 of which are much shorter than the others. The basiischium has a hook-like spine ventrally. The merus has a tooth on the dorsal and ventral sides. The carpus has a sharp spine at the middle of its inner border. The palm is rather broad and has several small teeth along its outer and inner borders. The fingers are longer than the palm and have several small teeth on their inner margin.

Walking legs.—The ambulatory legs are slender and are made up of the same number of segments, all of which bear a number of setae. The coxae of the first three have each a small spine.

Gills.—The same number of gills are present in this stage also.

Abdomen.—There are 6 segments and the telson. The first segment has no pleopods.

Each pleopod (fig. 264) has a protopodite, an exopodite fringed with plumose setae varying in number from 18–14, and a small endopodite carrying 3 hooks at its tip. The fifth pair are very small and their exopodites carry only 8 setae.

Telson.—The telson (fig. 265) is roughly semi-circular in shape.

Family PINNOTHERIDAE.

Pinnotheres sp.

Two stages of a species of *Pinnotheres* are present in the collection. They possess the characteristic three-lobed telson and the carapace possesses all the three spines, namely, rostral, dorsal and laterals quite well developed. In the latter character these larvae resemble the zoeae of *P. veterum*. But the latter, according to Lebour, has only 2 stages, the second metamorphosing directly into the megalopa. In this case, however, there seem to be more than two stages—probably 4. The earliest stage in the collection has 6 plumose setae on the exopodites and the abdominal somites are without pleopods. The other stage has 10 swimming setae and well-developed pleopods are present. One specimen of the latter stage matamorphosed into the megalopa directly, so that there is no doubt that it is the last zoeal stage. This megalopa is unfortunately missing so that no account of that stage can be given here.

Stage II—Fig. 266.—*Antennule—Fig.* 267.—This is an unsegmented process with 4 or 5 aesthetes at its tip.

Antenna—Fig. 268.—Is a small papilla which tapers distally.

Mandible.—The mandible has no palp.

First and Second Maxillae.—These are of the usual form, each having 2 endites.

First Maxilliped.—Basipodite has 10 setae on its inner margin. Endopodite is five-jointed, segments 1, 2 and 4 having 2 setae each. Segment 3 has only one and the last segment has 5, 4 terminally and one on the outer margin. Exopodite is unjointed and has 6 plumose setae.

Second Maxilliped.—Basipodite has only 3 setae. Endopodite is small, unjointed and armed with 4 setae, 3 of which are terminal and one on the outer margin. Exopodite is similar to that of the first.

Abdomen.—There are 5 segments besides the telson. The segments gradually increase in width towards the posterior end. Somites 2 and 3 have lateral knobs. There are no pleopods.

The telson (fig. 269) has the characteristic three lobes on its posterior edge. The median lobe is longer than the lateral ones which end in slender spines. Between the median and the lateral lobe on each side there are 3 setae. 2 minute teeth are present on the outer margin of the lateral lobe.

Stage IV.—The antennule has now a peduncle and 2 flagella the inner of which is only a rudiment.

The antenna has a well developed but unjointed flagellum.

Exopodites of the first 2 maxillipeds have 10 swimming setae each. Rudiments of the peraeopods are well developed, but the carapace does not cover them up completely.

The abdomen has now 6 segments, the last being cut off from the telson. The first segment has 2 short setae dorsally and is without pleopods. The last segment is also without appendages. The telson is unchanged.

LIST OF REFERENCES.

1. Alcock A. Materials for a Carcinological Fauna of India, No. 2. The Brachyura Oxystomata. J A. S. B. 65 : Part II, 1896.

2. Alcock A. Materials for a Carcinological Fauna of India, No. 6. The Brachyura Catometopa or Grapsoidea. Ibid 69 ; Part II, 1900.

3. Faxon, W. "On some young stages in the Development of Hippa, Porcellana and Pinnixia." Bull. Mus Comp. Zool. Harvard, Vol. V, 1879.

4. Gurney, R. 'Decapod Larvae.' 'Terra Nova' Expedition Report, Zoology, Vol. VIII 1924.

5 Gurney, R. Report on the Larvae of the Crustacea Decapoda—Zoological Results of the Cambridge Expedition to the Suez Canal. Trans. Zool. Soc. Lond. Vol. XXII, 1926—29.

6. Henderson, J. R. 'Challenger' Reports, Anomura.

7. Henderson, J. R. 'A contribution to Indian Carcinology—Trans. Linn. Soc. (2) V., 1893.

8. Hyman, O. W. Studies on Larvae of Crabs of the Family Pinnotheridae. Proc. U. S. Nat. Mus. No. 2497, Vol LXIV, 1924.

9. Kemp, S. Notes on Curstacea Decapoda in the Indian Muscum. XVII. 'On various Caridea.' Rec. Ind. Mus. Vol. XXVII, 1925.

10. Lebour, M. V. The Larval Stages of the Plymouth Brachura. Proc. Zool. Soc. Lond. 1928.

11. De Man, J. Decapoda—IV. Siboga Exped. 1920.

12. Menon, M. K. The Life Histories of Decapod Crustacea from Madras. Bull. Madras Mus. New Series—Nat. Hist. Section, Vol. II, No. 3, 1933.

13 Webb, G. E. The Larvae of the Decapoda Macrura and Anomura of Plymouth. J. Mar. Biol. Assc. Plymouth, XII 1921.

14. Williamson, H. C. Decapoden 1. Teil (Larven) Nordisches Plakton, 1915.

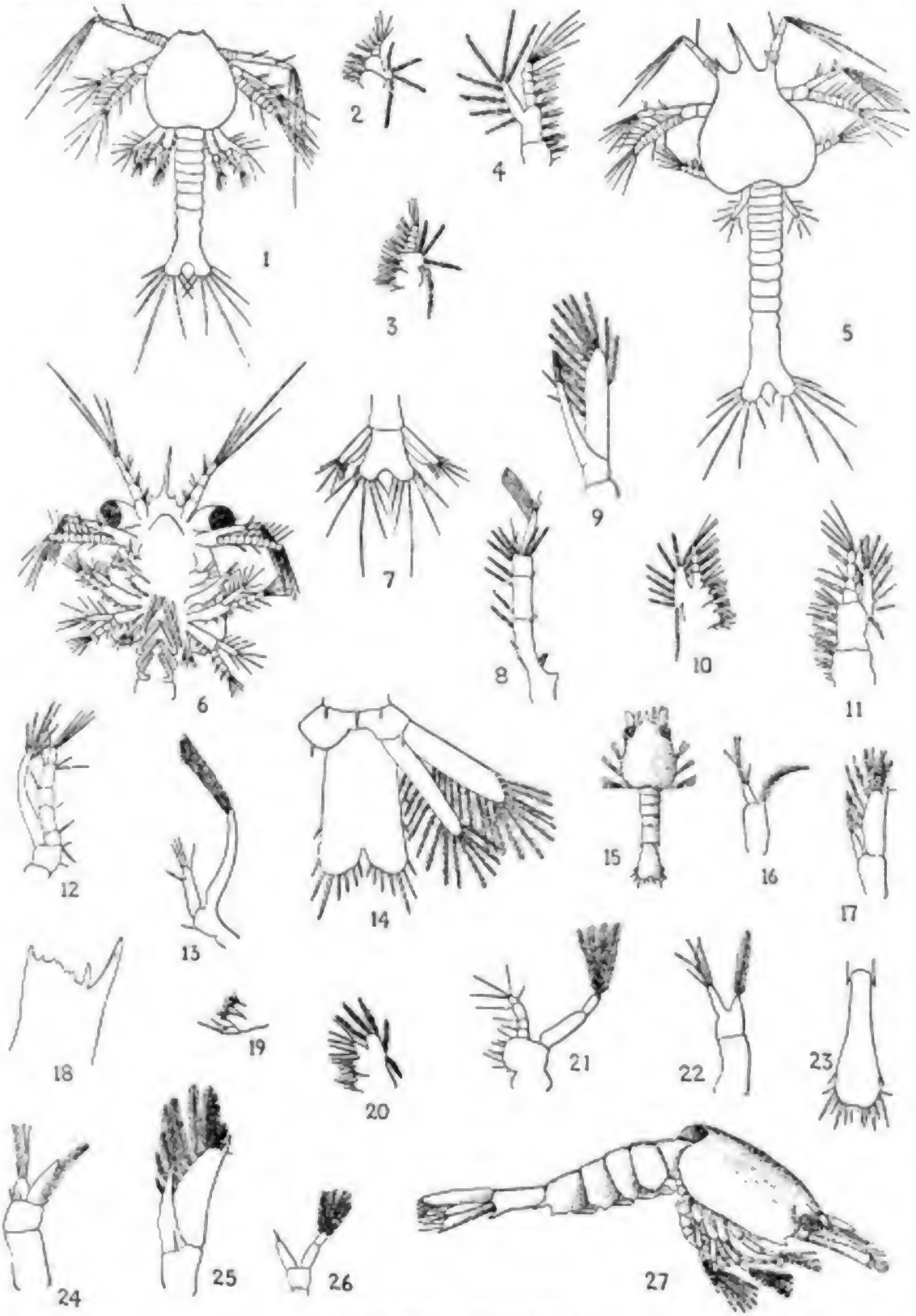
PLATE I.

Penaeus indicus.

Fig. 1. *First Protozoea.*—Entire animal × 50.
,, 2. *Do.* First maxilla × 82.
,, 3. *Do.* Second maxilla × 82.
,, 4. *Do.* First maxilliped × 82.
,, 5. *Second Protozoea* × 50.
,, 6. *Third Protozoea* (anterior part—ventral view) × 50.
,, 7. *Do.* Uropods and telson × 50.
,, 8. *First Schizopod stage.*—Antennule × 82.
,, 9. *Do.* *do.* Antenna × 82.
,, 10. *Do.* *do.* Second maxilla × 82.
,, 11. *Do.* *do.* First maxilliped × 82.
,, 12. *Do.* *do.* Third maxilliped × 82.
,, 13. *Do.* *do.* First Peraeopod × 82.
,, 14. *Do.* *do.* Uropods and telson × 82.

Leptochela Aculeocaudata

Fig. 15. *Stage I.*—Entire animal × 32.
,, 16. *Do.* Antennule × 130.
,, 17. *Do.* Antenna × 130.
,, 18. *Do.* Mandible × 650.
,, 19. *Do.* First maxilla × 130.
,, 20. *Do.* Second maxilla × 130.
,, 21. *Do.* First maxilliped × 130.
,, 22. *Stage II.*—Antennule × 130.
,, 23. *Do.* Telson × 65.
,, 24. *Stage III.*—Antennule × 130.
,, 25. *Do.* Antenna × 130.
,, 26. *Do.* First peraeopod × 65.
,, 27. *Do.* Entire animal × 32.



PENAEUS AND LEPTOCHELA.

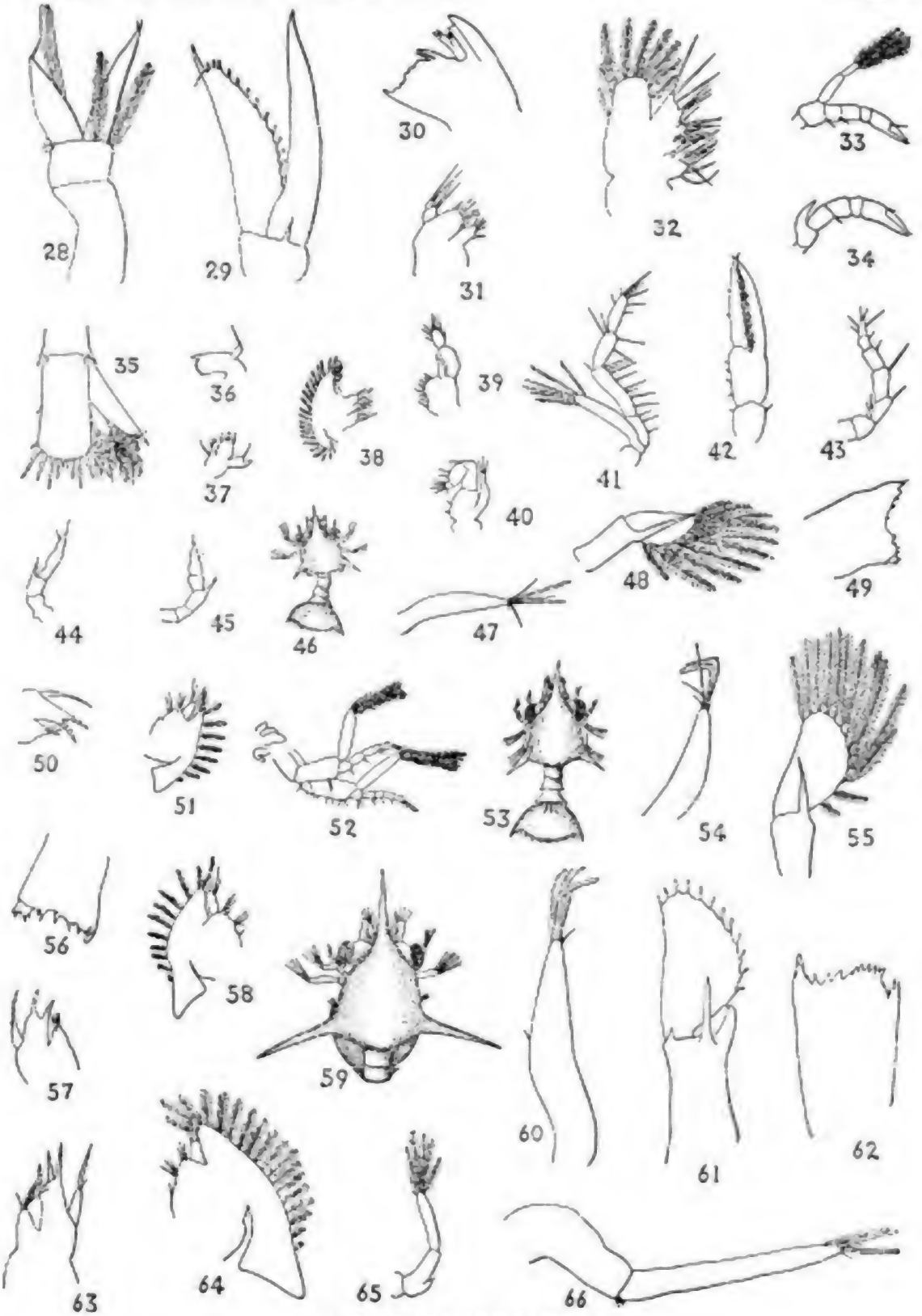
PLATE II.

Leptochela aculeocaudata.

Fig. 28. *Stage IV.*—Antennule × 130.
,, 29. *Do.* Antenna × 130.
,, 30. *Do.* Mandible × 325.
,, 31. *Do.* First maxilla × 130.
,, 32. *Do.* Second maxilla × 130.
,, 33. *Do.* First peracopod × 65.
,, 34 *Do.* Second peracopod × 65.
,, 35 *Do.* Uropods and telson × 65.
,, 36. *Young specimen.*—Mandible × 50.
,, 37. *Do.* *do.* First maxilla × 50.
,, 38. *Do.* *do.* Second maxilla × 50.
,, 39. *Do.* *do.* First maxilliped × 50.
,, 40. *Do.* *do.* Second maxilliped × 50.
,, 41. *Do.* *do.* Third maxilliped × 50.
,, 42. *Do.* *do.* Chela (of leg 2 of a slightly older specimen) × 50.
,, 43. *Do.* *do.* Third leg × 50.
,, 44. *Do.* *do.* Fourth leg × 50.
,, 45. *Do.* *do.* Fifth leg × 50.

Albunea symnista.

Fig. 46. *Stage I.*—Entire animal × 16.
,, 47. *Do.* Antennule × 130.
,, 48. *Do.* Antenna × 65.
,, 49. *Do.* Mandible × 325.
,, 50. *Do.* First maxilla × 130.
,, 51. *Do.* Second maxilla × 130.
,, 52. *Do.* Maxillipeds × 65.
,, 53. *Stage II.*—Entire animal × 16.
,, 54. *Do.* Antennule × 130.
,, 55. *Do.* Antenna × 16.
,, 56. *Do.* Mandible × 325.
,, 57. *Do.* First maxilla × 130.
,, 58. *Do.* Second maxilla × 130.
,, 59. *Stage III.*—Entire animal × 16.
,, 60. *Do.* Antennule × 130.
,, 61. *Do.* Antenna × 130.
,, 62. *Do.* Mandible × 325.
,, 63. *Do.* First maxilla × 130.
,, 64. *Do.* Second maxilla × 130.
,, 65. *Do.* Third maxilliped × 65.
,, 66. *Stage IV.*—Antennule × 65.



LEPTOCHELA AND ALBUNEA.

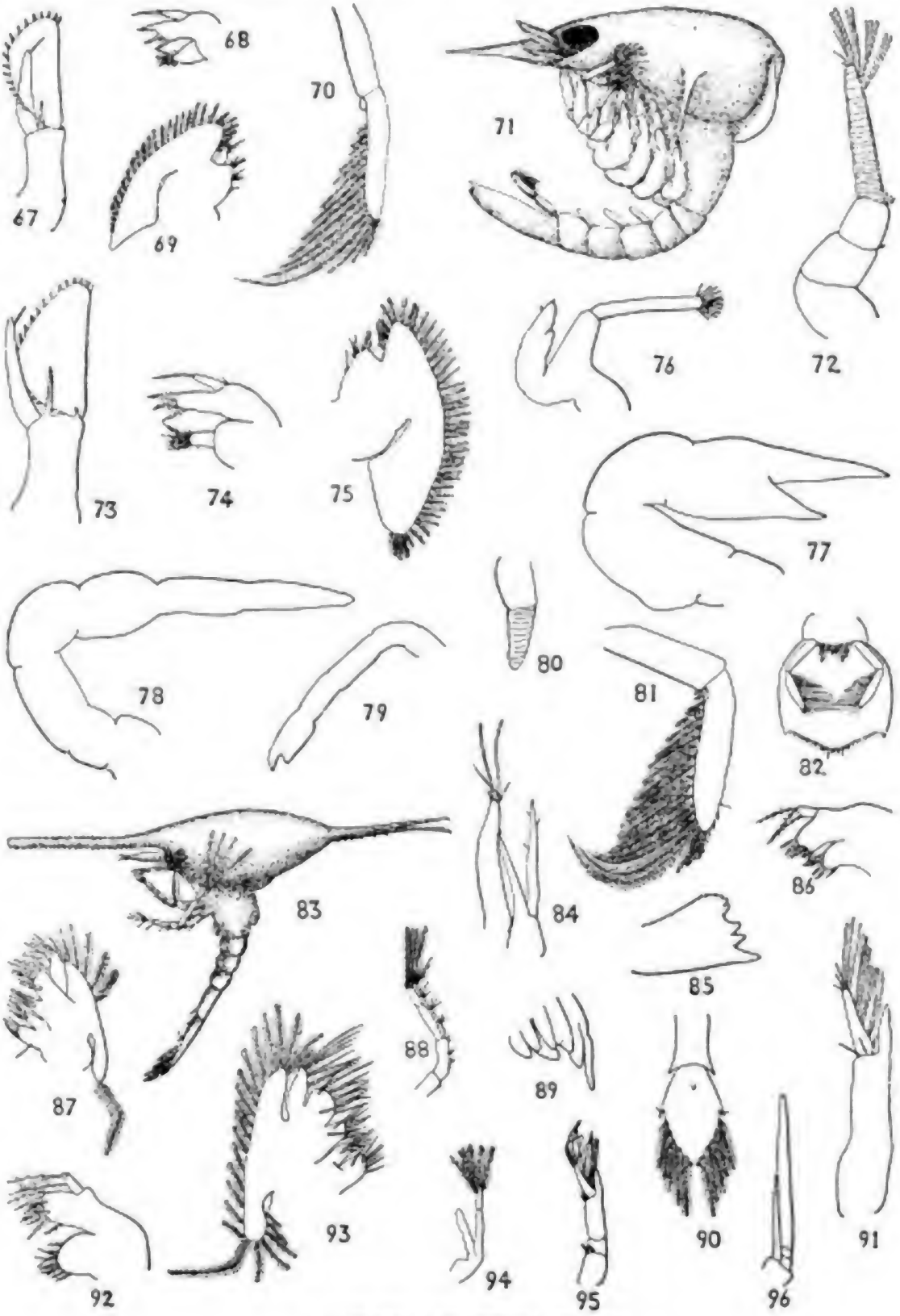
PLATE III.

Albunea symnista.

Fig. 67. *Stage IV.*—Antenna × 65.
,, 68. *Do.* First maxilla × 65.
,, 69. *Do.* Second maxilla × 65.
,, 70. *Do.* Uropod × 65.
,, 71. *Stage V.*—Entire animal × 16.
,, 72. *Do.* Antennule × 65.
,, 73. *Do.* Antenna × 65.
,, 74. *Do.* First maxilla × 65.
,, 75. *Do.* Second maxilla × 65.
,, 76. *Do.* Third maxilliped × 65.
,, 77. *Do.* First peraeopod × 65.
,, 78. *Do.* Second peraeopod × 65.
,, 79. *Do.* Last peraeopod × 65.
,, 80. *Do.* Pleopod × 65.
,, 81. *Do.* Uropod × 65.
,, 82. *Do.* Uropods and telson × 65.

? Petrolisthes sp. (I.)

Fig. 83. *Stage I.*—Entire animal × 32.
,, 84. *Do.* Antennule and antenna × 130.
,, 85. *Do.* Mandible × 325.
,, 86. *Do.* First maxilla × 130.
,, 87. *Do.* Second maxilla × 130.
,, 88. *Do.* First maxilliped × 650.
,, 89. *Do.* Third maxilliped × 130.
,, 90. *Do.* Telson (ventral side) × 65.
,, 91. *Stage II.*—Antennule × 130.
,, 92. *Do.* First maxilla × 130.
,, 93. *Do.* Second maxilla × 130.
,, 94. *Do.* Third maxilliped × 130.
,, 95. *Stage III.*—Antennule × 65.
,, 96. *Do.* Antenna × 65.



ALBUNEA AND PETROLISTHES.

PLATE IV.

? Petrolisthes sp. (I.)

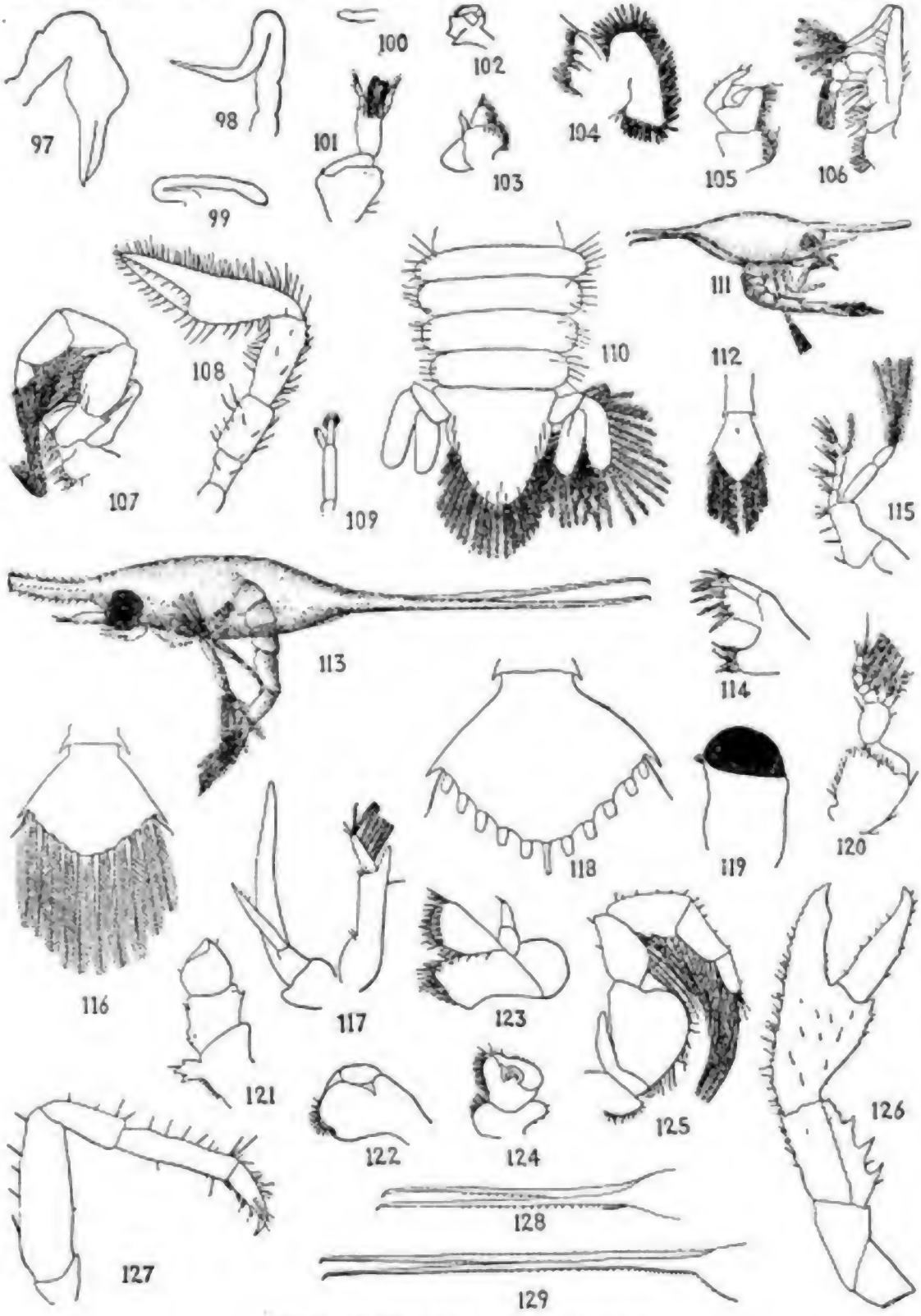
Fig. 97. *Stage III.*—Cheliped × 65.
,, 98. *Do.* Second peracopod × 65.
,, 99. *Do.* Last peracopod × 65.
,, 100. *Do.* Pleopod × 65.
,, 101. *First Post-larval stage.*—Antennule × 65.
,, 102. *Do.* *do.* Mandible × 65.
,, 103. *Do.* *do.* First maxilla × 65.
,, 104. *Do.* *do.* Second maxilla × 65.
,, 105. *Do.* *do.* First maxilliped × 65.
,, 106. *Do.* *do.* Second maxilliped × 65.
,, 107. *Do.* *do.* Third maxilliped × 65.
,, 108. *Do.* *do.* Cheliped × 65.
,, 109. *Do.* *do.* Pleopod × 65.
,, 110. *Do.* *do.* Abdomen × 65.

? Petrolisthes sp. (II.)

Fig. 111. *Stage I.*—Entire animal × 32.
,, 112. *Do.* Telson × 65.

Porcellanella sp.

Fig. 113. *Stage I.*—Entire animal × 32.
,, 114. *Do.* First maxilla × 130.
,, 115. *Do.* First maxilliped × 65.
,, 116. *Do.* Telson (dorsal side) × 65.
,, 117. *Stage II.*—Antennule and Antenna × 65.
,, 118. *Do.* Telson × 65.
,, 119. *First Post-larval stage.*—Eye × 130.
,, 120. *Do.* *do.* Antennule × 151.
,, 121. *Do.* *do.* Base of Antenna × 151.
,, 122. *Do.* *do.* Mandible × 151.
,, 123. *Do.* *do.* First maxilla × 151.
,, 124. *Do.* *do.* First maxilliped × 151.
,, 125. *Do.* *do.* Third maxilliped × 151.
,, 126. *Do.* *do.* Cheliped × 151.
,, 127. *Do.* *do.* Second Peracopod × 151.
,, 128. Posterior horns of form 1 × 32.
,, 129. Posterior horns of form 2 × 32.



PETROLISTHES AND PORCELLANELLA.

PLATE V.

Porcellanella sp.

Fig. 130. Part of rostrum of form 3 × 325.
" 131. Telson of rostrum of form 3 × 65.

Spiropagurus spiriger.

Fig. 132. *Stage I.*—Entire animal × 50.
" 133. *Do.* Antennule × 82.
" 134. *Do.* Antenna × 82.
" 135. *Do.* Mandible × 82.
" 136. *Do.* First maxilla × 82.
" 137. *Do.* Second maxilla × 82.
" 138. *Do.* First maxilliped × 82.
" 139. *Do.* Telson × 82.
" 140. *Stage II.*—First maxilla × 82.
" 141. *Do.* Third maxilliped × 82.
" 142. *Stage III.*—Uropod × 82.
" 143. *Stage IV.*—Antennule × 82.
" 144. *Do.* Antenna × 82.
" 145. *Do.* Second maxilla × 82.
" 146. *Do.* Pleopod × 82.
" 147. *Do.* Telson and Uropods × 82.
" 148. *Glaucothoe*—Entire animal × 50.
" 149. *Do.* First maxilliped × 82.
" 150. *Do.* Second maxilliped × 82.
" 151. *Do.* Pleopod × 82.

? Diogenes pugilator.

Fig. 152. *Stage I.*—Entire animal × 50.
" 153. *Stage II.*—Telson × 82.
" 154. *Stage III.*—Telson and Uropods × 82.
" 155. *Do.* Posterior edge of Telson × 500.
" 156. *Glaucothoe*—Anterior end of animal × 50.
" 157. *Do.* First maxilliped × 82.
" 158. *Do.* Abdomen × 82.

Diogenes sp. 1.

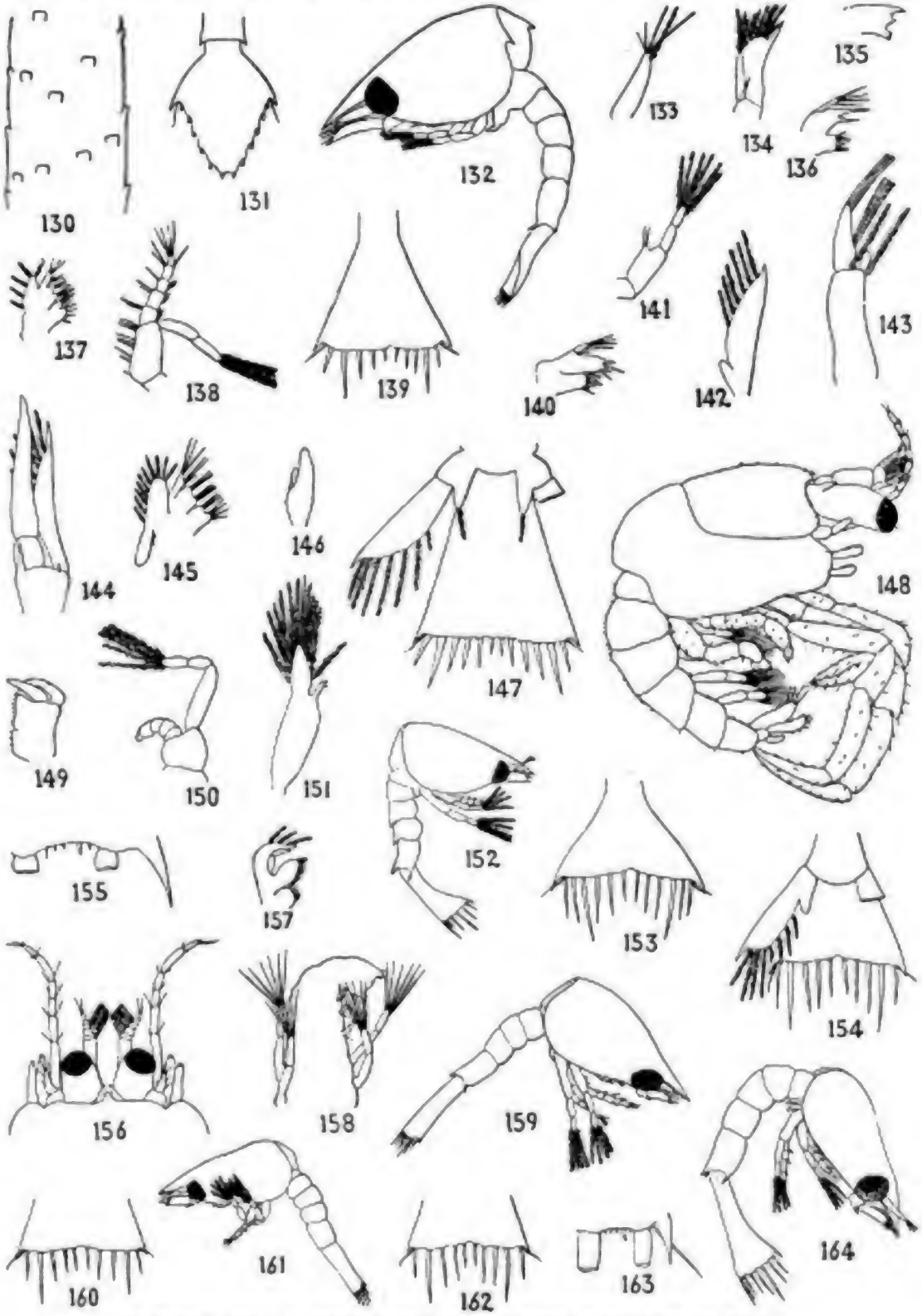
Fig. 159. *Stage I.*—Entire animal + 50.
" 160. *Stage III.*—Telson × 82.

Diogenes sp. 2.

Fig. 161. *Stage I.*—Entire animal × 50.
" 162. *Stage III.*—Telson × 82.
" 163. *Do.* Posterior edge of telson × 300.

? Clibanarius sp.

Fig. 164. *Stage I.*—Entire animal × 50.



PORCELLANELLA, SPIROPAGURUS, DIOGENES AND CLIBANARIUS.

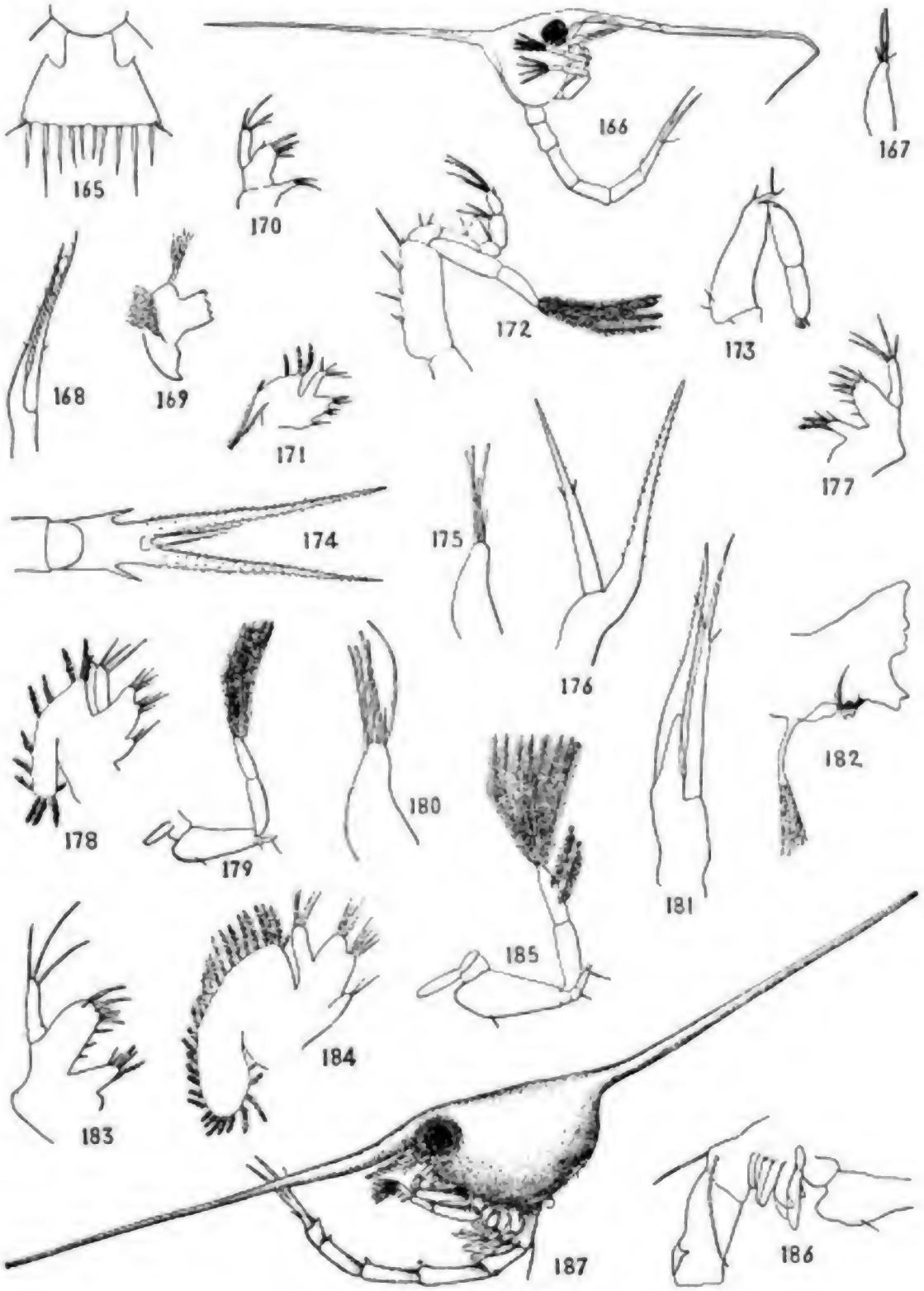
PLATE VI.

? Clibanarius sp.

Fig. 165. *Stage III.*—Telson × 82.

Ethusa investigatoris.

Fig. 166. *Stage I.*—Entire animal × 32.
„ 167. *Do.* Antennule × 130.
„ 168. *Do.* Antenna × 130.
„ 169. *Do.* Mandible × 130.
„ 170. *Do.* First maxilla × 130.
„ 171. *Do.* Second maxilla × 130.
„ 172. *Do.* First maxilliped × 130.
„ 173. *Do.* Second maxilliped × 130.
„ 174. *Do.* Telson × 130.
„ 175. *Stage II.*—Antennule × 130.
„ 176. *Do.* Antenna × 130.
„ 177. *Do.* First maxilla × 130.
„ 178. *Do.* Second maxilla × 130.
„ 179. *Do.* Second maxilliped × 65.
„ 180. *Stage III.*—Antennule × 130.
„ 181. *Do.* Antenna × 130.
„ 182. *Do.* Mandible × 130.
„ 183. *Do.* First maxilla × 130.
„ 184. *Do.* Second maxilla × 130.
„ 185. *Do.* Second maxilliped × 65.
„ 186. *Do.* Leg rudiments × 65.
„ 187. *Stage IV.*—Entire animal × 16.



CLIBANARIUS AND ETHUSA.

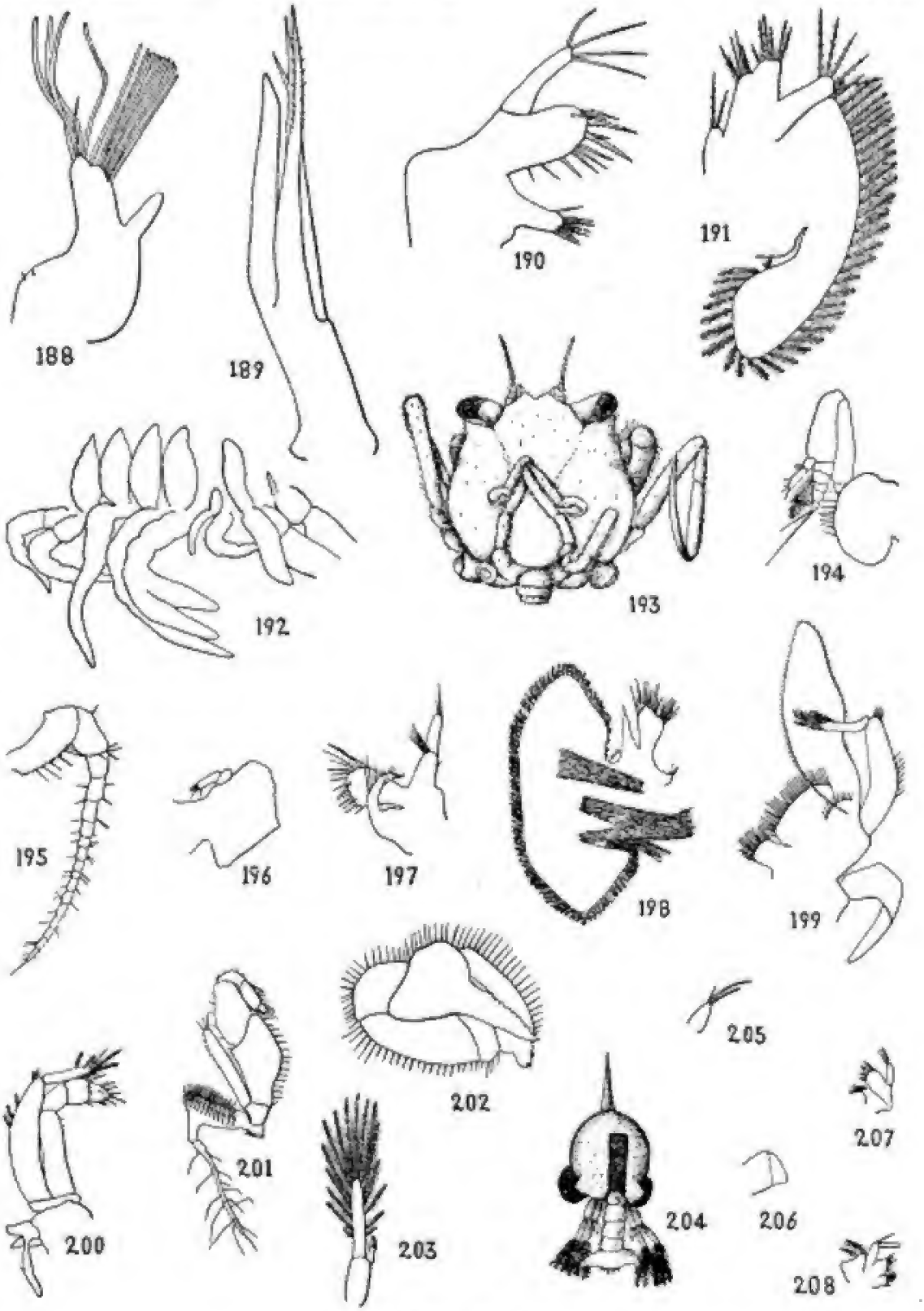
PLATE VII.

Ethusa investigatoris.

Fig. 188. *Stage IV.*—Antennule × 130.
,, 189. *Do.* Antenna × 130.
,, 190. *Do.* First maxilla × 130.
,, 191. *Do.* Second maxilla × 130.
,, 192. *Do.* Leg rudiments.
,, 193. *Megalopa.*—Entire animal × 16.
,, 194. *Do.* Antennule × 65.
,, 195. *Do.* Antenna × 65.
,, 196. *Do.* Mandible × 65.
,, 197. *Do.* First maxilla × 65.
,, 198. *Do.* Second maxilla × 65.
,, 199. *Do.* First maxilliped × 65.
,, 200. *Do.* Second maxilliped × 65.
,, 201. *Do.* Third maxilliped × 65.
,, 202. *Do.* Cheliped × 65.
,, 203. *Do.* Pleopod × 65.

Philyra scabriuscula.

Fig. 204. *Stage I.*—Entire animal × 65.
,, 205. *Do.* Antennule × 130.
,, 206. *Do.* Mandible × 130.
,, 207. *Do.* First maxilla × 130.
,, 208. *Do.* Second maxilla × 130.



ETHUSA AND PHILYRA.

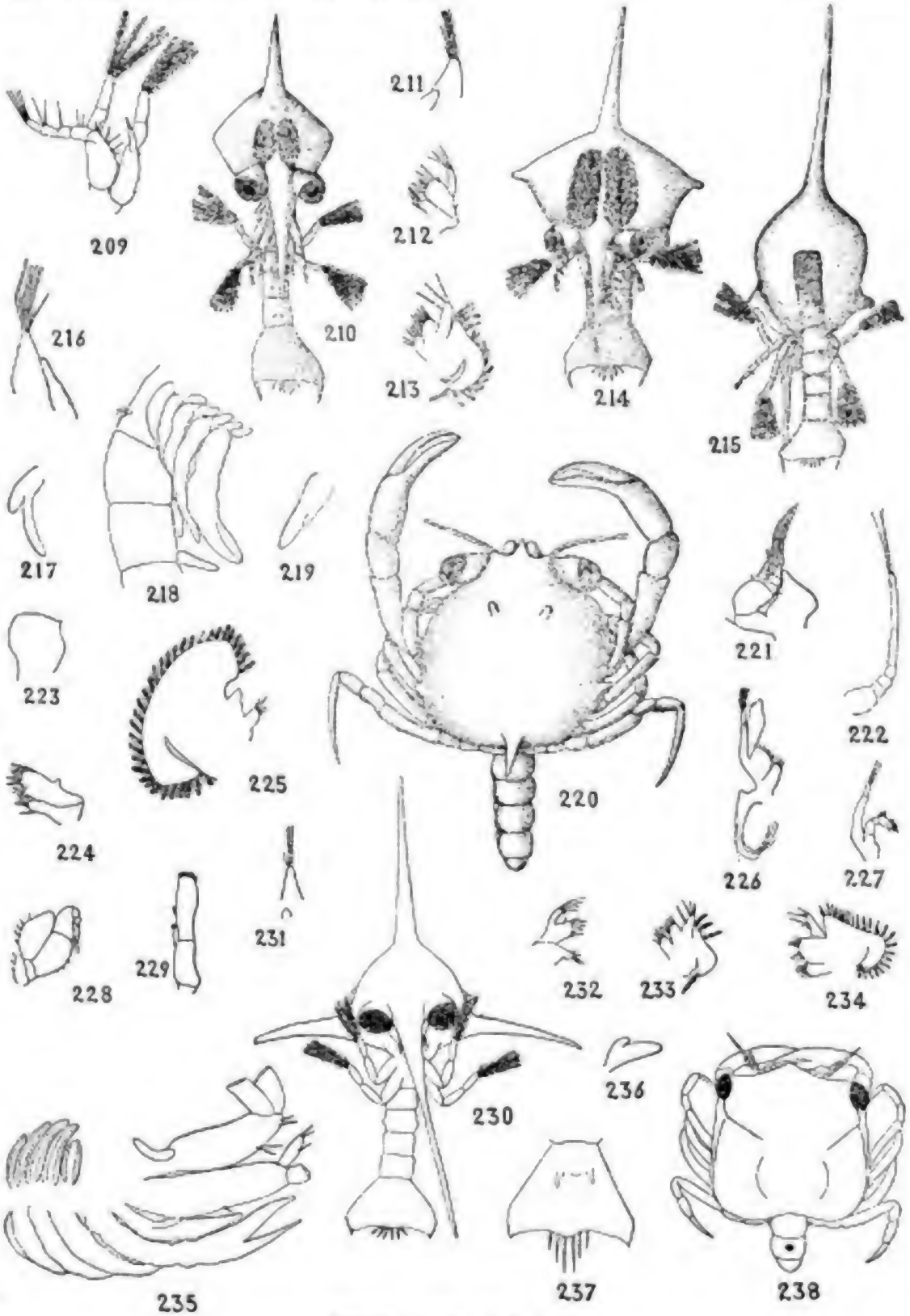
PLATE VIII.

Philyra scabriuscula.

Fig. 209. *Stage I.*—Maxilliped × 130.
,, 210. *Stage II.*—Entire animal × 65.
,, 211. *Do.* Antennule and antenna × 130.
,, 212. *Do.* First maxilla × 130.
,, 213. *Do.* Second maxilla × 130.
,, 214. *Stage III.*— } Entire animal × 65.
,, 215.
,, 216. *Do.* Antennule and antenna × 130.
,, 217. *Do.* Third maxilliped × 130.
,, 218. *Do.* Leg rudiments × 301.
,, 219. *Do.* Pleopod × 130.
,, 220. *Megalopa.*—Entire animal × 65.
,, 221. *Do.* Antennule × 130.
,, 222. *Do.* Antenna × 130.
,, 223. *Do.* Mandible × 130.
,, 224. *Do.* First maxilla × 130.
,, 225. *Do.* Second maxilla × 130.
,, 226. *Do.* First maxilliped × 130.
,, 227. *Do.* Second maxilliped × 130.
,, 228. *Do.* Third maxilliped × 130.
,, 229. *Do.* Pleopod × 65.

? Leucosia sp.

Fig. 230. *Stage I.*—Entire animal × 50.
,, 231. *Do.* Antennule and antenna × 82.
,, 232. *Do.* First maxilla × 82.
,, 233. *Do.* Second maxilla × 82.
,, 234. *Stage III.*—Second maxilla × 82.
,, 235. *Stage IV.*—Leg rudiments × 82.
,, 236. *Do.* Pleopod × 82.
,, 237. *Do.* Telson × 82.
,, 238. *Megalopa* × 25.



PHILYRA AND LEUCOSIA.

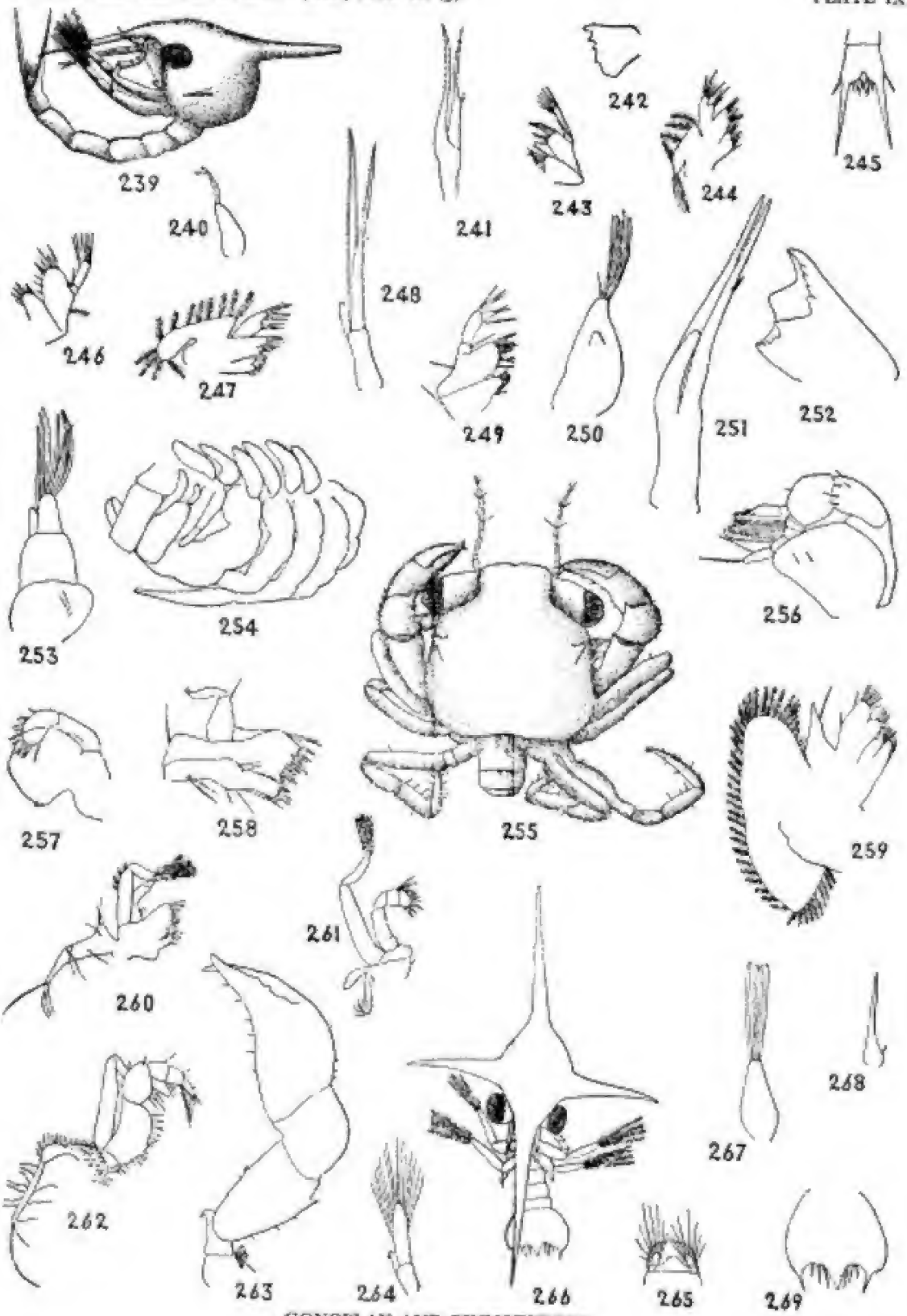
PLATE IX.

Gonoplax sp.

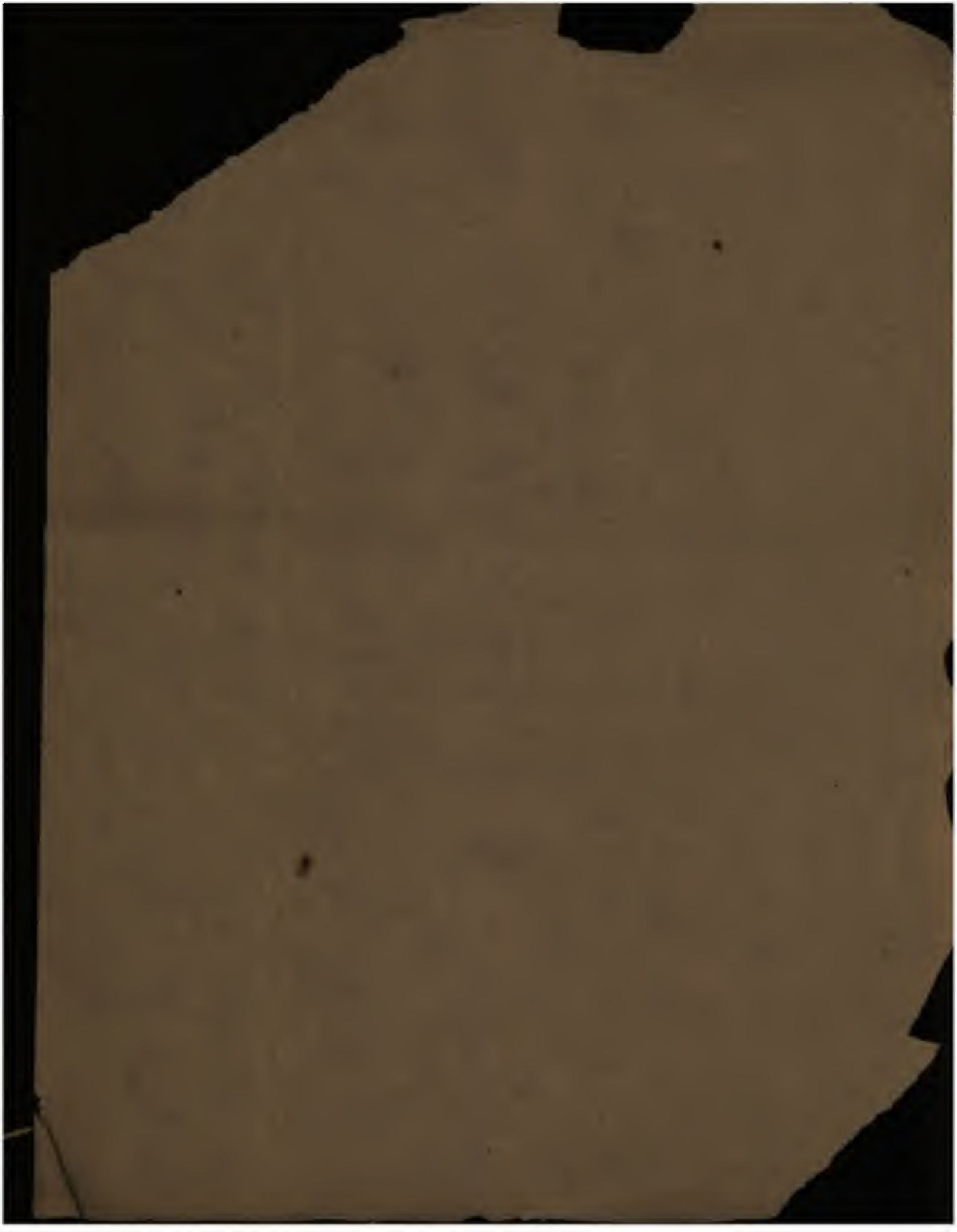
Fig. 239. *Stage I.*—Entire animal × 65.
,, 240. *Do.* Antennule × 130.
,, 241. *Do.* Antenna × 130.
,, 242. *Do.* Mandible × 130.
,, 243. *Do.* First maxilla × 130.
,, 244. *Do.* Second maxilla × 130.
,, 245. *Do.* Telson × 65.
,, 246. *Stage II.*—First Maxilla × 130.
,, 247. *Do.* Second maxilla × 130.
,, 248. *Stage III.*—Antenna × 130.
,, 249. *Do.* First maxilla × 130.
,, 250. *Stage IV.*—Antennule × 130.
,, 251. *Do.* Antenna × 130.
,, 252. *Do.* Mandible × 130.
,, 253. *Stage V.*—Antennule × 130.
,, 254. *Stage V.*—Leg rudiments × 65.
,, 255. *Megalopa.*—Entire animal × 32.
,, 256. *Do.* Antennule × 130.
,, 257. *Do.* Mandible × 130.
,, 258. *Do.* First maxilla × 130.
,, 259. *Do.* Second maxilla × 130.
,, 260. *Do.* First maxilliped × 65.
,, 261. *Do.* Second maxilliped × 65.
,, 262. *Do.* Third maxilliped × 65.
,, 263. *Do.* Cheliped × 65.
,, 264. *Do.* Pleopod × 65.
,, 265. *Do.* Telson and last pleopod × 65.

Pinnotheres sp.

Fig. 266. *Stage II.*—Entire animal × 50.
,, 267. *Do.* Antennule × 300.
,, 268. *Do.* Antenna × 300.
,, 269. *Do.* Telson × 82.



GONOPLAX AND PINNOTHERES.



AGENTS FOR THE SALE OF MADRAS GOVERNMENT PUBLICATIONS

IN INDIA

[illegible]

NOTICE

Official publications may be obtained at the higher discounts allowed above from the office of the High Commissioner for India, India House, Aldwych, London, W.C. 2, or through any bookseller.